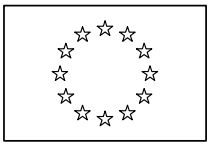

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COMMISSION STAFF WORKING DOCUMENT

Report on European Technology Platforms and Joint Technology Initiatives: Fostering Public-Private R&D Partnerships to Boost Europe's Industrial Competitiveness

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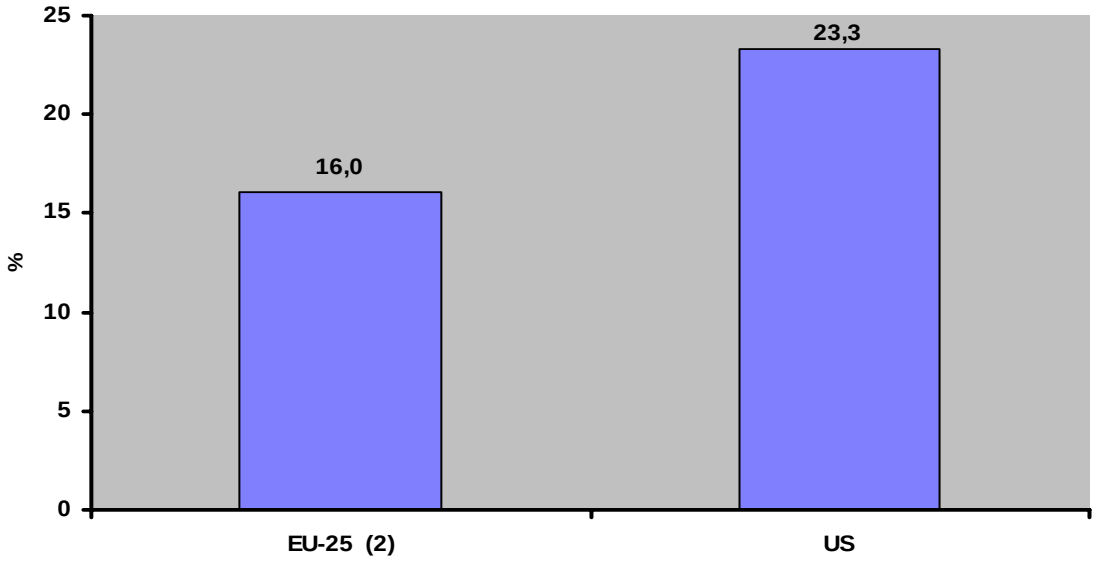
1. POLICY CONTEXT

At the Spring European Council 2005, the heads of government relaunched the Lisbon strategy with a new partnership for growth and employment. To this end, the conclusions of the European Council underlined the core role of knowledge and innovation as engines of sustainable growth and stated that "the European area of knowledge should enable undertakings to build new competitive factors, consumers to benefit from new goods and services and workers to acquire new skills. With that in mind, it is important to develop research, education and all forms of innovation insofar as they make it possible to turn knowledge into added value and create more and better jobs".

To realise this ambition and to ensure a solid industrial fabric throughout the European territory, a **stronger link between research and industry** is particularly important. Industry has, clearly, a key role to play in this endeavour.

However, European industry is increasingly hindered by inadequate technological content, arising particularly from lack of specialisation in high technology sectors, as Figure 1 shows.

Figure 1: Share of High-Tech Industries (1) in Manufacturing Value Added, 2002



Source: European Commission calculations based on data from Groningen Growth and Development Centre

Notes: (1) High-Tech industries are defined as: (i) Office, accounting and computing machinery (ii) Radio, television and communications equipment (iii) Aircraft and spacecraft (iv) Pharmaceuticals. Pharmaceuticals include other products of the chemical industry as a breakdown between pharmaceuticals and other products of the chemical industry is not available.
(2) EU-25 does not include data for Estonia, Cyprus, Latvia, Lithuania, Malta and Slovenia.

Moreover, the potential of the research sector to contribute to redressing this situation is weakened by inadequate funding and lack of scale to focus on key strategic projects that have high downstream industrial potential.

Accordingly, **increasing the scale and impact of research investment, enhancing the co-ordination of research** in Europe and **raising the technology content of industrial activity** are critical if Europe is to strengthen its position as a technologically innovative economy with the capacity to develop a comparative advantage in new areas. Such developments would also have the potential to contribute to a major increase in private investment in R&D and hence make a significant contribution to achieving the objectives set at the Barcelona European Council of increasing investment in research to approaching 3% of GDP by 2010, with two-thirds of the new investment coming from the private sector[1].

Public-private partnerships involving industry, the research community and public authorities can play a significant role in meeting these challenges. At national level, the potential role of such public-private partnerships is increasingly being recognised. For example, the share of public-private partnerships in competitive funding of research in France increased from 37% in 1998 to 78% in 2002 and the Dutch government has reserved €805 million for public-private research proposals in strategic areas for the 2003-10 period[2]. Similar public-private partnerships are also being put in place at intergovernmental level, such as between Germany and France in the fields of biophotonics, molecular imagery and interoperability of multimedia networks.

At European level, there have been repeated calls for **more efficient investment** by bringing together public and private actors. In this regard, the European Initiative for Growth drew attention to the urgency of stepping up public and, especially, private investment in leading-edge technologies with a view to stimulating growth and employment[3]. Moreover, the 2004 Spring European Council pointed to the potential scope for giving greater emphasis to R&D projects in key growth technologies, such as eco-innovation and environmental technologies[4].

In drawing attention to the necessity of pursuing an active industrial policy, the Spring European Council 2005 recognised the role of "technology initiatives based on **public-private partnerships**" and "the organisation of European Technology Platforms aimed at setting **long-term research agendas**" in "strengthening the competitive advantages of the industrial base while ensuring the complementarity of action at national, trans-national and European level"[5].

In this context, this **report follows up the conclusions of the Spring European Council 2005** and sets out the preparatory work carried out in relation to Joint Technology Initiatives and European Technology Platforms. The objective of the Commission services in presenting the report is to begin to prepare the way for the launch of Joint Technology Initiatives and the implementation of the relevant parts of the Strategic Research Agendas of European

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1 Conclusions of the Barcelona European Council, 15-16 March 2002, page 20

2 OECD Science, Technology and Industry Outlook, 2004, page 92

3 COM(2003) 690 of 21.11.2003

4 Conclusions of the Spring European Council 25-26 March 2004, page 8 and conclusions of the Spring European Council 22-23 March 2005, page 6

5 Conclusions of the Spring European Council, 22-23 March 2005, page 5

Technology Platforms in line with the timescale for the Seventh Framework Programme proposed for 2007-2013[6].

In its proposal for the 7th Framework Programme, the Commission has introduced the concept of Joint Technology Initiatives as a **new way of realising public-private partnerships at European level**. The European Commission has flagged such possible initiatives in six areas of high industrial and policy interest. Their selection and the modalities for their implementation, for example through joint undertakings on the basis of article 171 of the EU Treaty, are key issues. Technology initiatives are one expression, amongst others, of the EU's strong intention to coordinate research efforts and to respond to industry needs. Depending on their impact and success, their suitability for other areas of research than those flagged so far should be further examined.

The present **report is structured in three parts** covering the development and current state of play of European Technology Platforms, the technical approaches envisaged to implement European Technology Platforms and the identification process and potential implementation modalities for the proposed Joint Technology Initiatives.

2. DEVELOPMENT AND CURRENT STATE OF PLAY OF EUROPEAN TECHNOLOGY PLATFORMS

2.1. Definition and Role

European Technology Platforms are an effective means of defining research and development priorities, timeframes and action plans on a number of **strategically important issues** where achieving Europe's future growth, competitiveness and sustainability objectives is dependent on major research and technological advances in the medium to long term. They focus on areas of significant economic impact and high societal relevance where there is high public interest and scope for genuine value added through a European level response**.** As such, they are potentially a powerful instrument in achieving a **better structuring of activities** at European level and contributing to the **achievement of the European Research Area**.

European Technology Platforms provide a **framework for addressing major technological challenges**. Recognising that the main objective of European Technology Platforms is to contribute to the achievement of Europe's competitiveness objectives, it is appropriate that the definition of Strategic Research Agendas be led primarily by industry. However, to ensure that European Technology Platforms achieve optimum results and reflect wider Community interests, public authorities and all other relevant stakeholders should also be actively involved.

Europe does not currently have sufficient capacity to transform knowledge into commercial products and services. By providing a framework within which industry, the research community and the financial world can come together and agree long-term research agendas with concrete deliverables, European Technology Platforms can **increase Europe's innovative capacity**. This is the case, for example, in areas where market failures hinder

[6] Proposal for a Decision of the European Parliament and the Council concerning the Seventh Framework Programme of the European Community for Research, Technological Development and Demonstration Activities (2007-2013), COM(2005) 119

technological development that could contribute to sustainability as well as competitiveness, such as with environmental technologies[7].

The development of European Technology Platforms is essentially a **"bottom-up" process**. The Commission began promoting the concept in 2003 and encouraged interested parties to come together and consider setting up platforms at European level. Hence, it is the stakeholders themselves who take the initiative to set up a European Technology Platform, with the support and guidance of the European Commission, as appropriate.

Each platform has its own origins and approach and its own particular way of working. Nonetheless, experience to date indicates that, in general, European Technology Platforms follow a **three-stage process** and that successful completion of each is a prerequisite for effective implementation of the subsequent stages.

Stage 1: Emergence and Setting Up: In this stage, stakeholders are brought together. Industry plays an initiating role in this regard with the aim of achieving consensus on the way forward. The main deliverable is a **strategic vision document** reflecting this consensus and endorsed by top executives from leading companies in the sector. The vision document explains the strategic importance of the activity and gives an outline of the desired medium and long term development objectives of the European Technology Platform. It also explains why action at European level is required. At this stage, the main principles for the governance of the platform are established.

Stage 2: Definition of a Strategic Research Agenda: The Strategic Research Agenda is the key deliverable of a European Technology Platform. It should set out research and technological development priorities for the medium to long term, including measures for enhancing networking and clustering of the RTD capacity and resources in Europe.

The definition of a Strategic Research Agenda is commonly co-ordinated by an advisory council that includes **representation from a wide range of stakeholders**. In many cases, the active involvement of Member States is channelled through a "mirror group" that reflects their views as the Strategic Research Agenda takes shape. Steering panels undertake the detailed work of defining the Strategic Research Agenda, often supported by specialised working groups.

In parallel with the definition of a Strategic Research Agenda, European Technology Platforms begin to specify a **deployment strategy** at this stage. The deployment strategy anticipates the key elements required in order to implement the Strategic Research Agenda effectively with the aim of bridging the gap between the current state of development of a given technology and its eventual deployment. It should take into account, for example, the need for mechanisms to mobilise private and public investments, strategies to implement optimal demonstration activities, actions related to education and training and the establishment of an ongoing communication process. It should also capitalise on possible synergies with other European Technology Platforms and address any possible overlap or duplication of activities across platforms.

Stage 3: Implementation of the Strategic Research Agenda: During this phase, the Strategic Research Agendas defined within European Technology Platforms are implemented with the support of Community research programmes as appropriate, where they are compatible with

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[7] The establishment of European Technology Platforms is identified as a priority action in the Environmental Technologies Action Plan, COM(2004) 38

the objectives of European research and competitiveness policies, together with other policies where relevant. At the same time, the Strategic Research Agendas will make an important contribution to the preparation of the Commission's proposals for future research programmes. It is, however, important to stress that the implementation of Strategic Research Agendas is likely to involve support from a range of sources, including the Framework Programme, other sources of European funding, national research programmes, industry funding and third-party private finance.

As the shape of a European Technology Platform evolves through these three stages, it remains flexible and open to entities joining or leaving the platform as well as to the integration of new initiatives. Thus, as it moves from the vision and strategy phases to the implementation phase, its character and structure can also change.

It is noteworthy that, despite the open approach taken, the number of European Technology Platforms being set up has not grown exponentially. There are **currently 25 platforms** at various stages of development.

Most of the European Technology Platforms address technological challenges that can potentially **contribute to a number of key policy objectives** which are essential for Europe's future competitiveness including:

- **timely development and deployment of new technologies** that offer the potential of radical change in one or more industrial sectors (hydrogen and fuel cells, nanomedicine, plant genomics and new electronic media);

- technology development to meet different policy objectives with a view to **sustainable development** (water supply and sanitation, photovoltaics, sustainable chemistry, global animal health, road transport, rail transport, maritime transport, , industrial safety, clean power and advanced engineering materials);

- **new technology-based public goods and services** with high entry barriers and uncertain profitability but which offer significant economic potential (innovative medicines and mobile and wireless communications);

- achieving the necessary technological breakthroughs to remain at the leading edge in **high technology sectors** that have significant strategic and economic importance (aeronautics, nanoelectronics, embedded computing systems);

- renewal, revival or **restructuring of traditional industrial sectors** (steel, textiles and clothing, forest resources, manufacturing and construction).

2.2. Key Success Factors of European Technology Platforms

The experience built up as the European Technology Platforms have developed allows conclusions to be drawn about the factors that are essential for their **successful development**.

A number of these relate to the organisation and governance structures of European Technology Platforms. Firstly, it is essential that European Technology Platforms have **strong leadership** with the credibility to bring together and mobilise stakeholders. To this end, it is important that industry involvement in platforms should be at a sufficiently strategic level within companies to ensure the commitment of its top management and to have the necessary impact on its research strategy.

Secondly, European Technology Platforms must be **open and avoid becoming "closed shops"** of narrow industry groupings or other stakeholder lobbies. Each platform must have "clear rules of the game" that ensure openness to all relevant stakeholders of all sizes. In this regard, the industrial leaders of European Technology Platforms have signed up to a voluntary **code of good practice on openness and transparency** vis-à-vis all relevant stakeholders, including notably small and medium-sized enterprises as well as groups representing wider societal interests.

Thirdly, each European Technology Platform has its own characteristics, history and modus operandi. Accordingly, platforms must have the freedom to determine the most appropriate organisational structure. **A "one-size-fits-all" approach is not appropriate**. Where platforms address technological challenges that are horizontal in nature, such as potential benefits for health and environment, they generally require intensive involvement of a wide spectrum of stakeholders. Where platforms are set up to tackle challenges that are more vertical in nature, such as sectorally-driven technologies, they tend to be led by a smaller number of stakeholders, with other players focusing their participation on particular aspects of the platform.

In addition, European Technology Platforms should put in place a **clear operational focus from an early stage** so that research activities begin in a concrete way. Discussion and debate between stakeholders is important in the development phase, but platforms should avoid becoming "talking shops".

Moreover, the **committed involvement of national authorities** in European Technology Platforms is essential, particularly given the value added that can be achieved through the co-ordination of national research activities in the field concerned around the platform's overall objectives. Platforms should take this into account in developing their structures. The experience with Member State "mirror groups" suggests that, for many European Technology Platforms, this has proved a good model.

Furthermore, European Technology Platforms should be **proactive in identifying sources of financing**. They should not focus exclusively on Community and national public funding sources, but should also identify potential sources of private funding and should seek to develop a viable financing engineering strategy that avails of loan and equity funding and accesses guarantee facilities where possible. Thus, the role of public funding should be to leverage substantial private investment in the Strategic Research Agendas of the European Technology Platforms.

2.3. Role of the European Commission

The Commission ensures that the European dimension is properly addressed by platforms. In this regard, the role of the Commission varies depending on the stage of development. During the initial setting-up phase, the role of the Commission is to promote the concept. It encourages the process of defining a long-term vision and Strategic Research Agenda. This process is very much owned by the stakeholders and by industry in particular. Nonetheless, the supportive involvement of the Commission is often important in encouraging potential stakeholders to commit to the work of the platform.

In this regard, the Commission participates as an observer in meetings of European Technology Platforms, providing advice and guidance on issues such as transparency and openness. It makes stakeholders aware of aspects such as Community Support Programmes and financial engineering. The Commission also draws attention from the outset to the

legislative and policy framework in which the technology concerned is being developed, including health and consumer protection[8], environment, intellectual property and standardisation. Where appropriate and in line with European research priorities, the Commission also provides limited Community financial support for operational entities, such as secretariats. In addition, the Commission funds, where appropriate, existing collaborative research projects that are integrated into European Technology Platforms as they are set up.

The Commission is not bound by the work of any platform. It does, however, intend to **provide the necessary support in the implementation stage** of those parts of the Strategic Research Agendas and deployment strategies of platforms that fit with the goals of European research policy.

To this end, the Commission has examined the status of all European Technology Platforms and, where possible and appropriate, it has **taken account of their Strategic Research Agendas** in the formulation of its proposal for the Seventh Framework Programme. Community support for the implementation of the Strategic Research Agendas of European Technology Platforms will, nonetheless, be subject to the **normal rules and procedures** of the Seventh Framework Programme, including submission and evaluation of proposals in response to open calls.

3. TOWARDS IMPLEMENTATION OF EUROPEAN TECHNOLOGY PLATFORMS

Implementation of European Technology Platforms will require effective combination of a range of funding sources. In line with state aid rules, these include public funding at Member State level and private investment in addition to Community support through the Framework Programme. Complementary funding from the Structural Funds could also be mobilised where appropriate.

With regard to the European funding element, the **use of the regular instruments of collaborative research** is likely to be the most effective way of providing Community support for the implementation of the EU-relevant parts of the majority of Strategic Research Agendas developed by the European Technology Platforms. To this end, the Strategic Research Agendas of many European Technology Platforms have been an important, though not the sole, input to the identification of the thematic priorities for the Seventh Framework Programme.

There are, in addition, a limited number of European Technology Platforms which offer the opportunity for significant technological advances and which have achieved such a scale and scope that implementation of important elements of their Strategic Research Agendas requires the setting up of long-term public-private partnerships. In these cases, loose co-ordination through the European Technology Platform and support through the regular instruments of the Framework Programme for Research and Development is not sufficient. Effective implementation requires a dedicated mechanism that enables coherent, large-scale legal structures to be set up to provide the necessary leadership to achieve the research objective. To meet effectively the needs of this small number of European Technology Platforms, it is proposed to set up **"Joint Technology Initiatives"**.

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[8] Articles 152 and 153 of the Treaty require a high level of health and consumer protection respectively. See also the Commission Communication "Healthier, Safer, more confident citizens: a health and consumer protection strategy" and Proposal for a Decision establishing a programme of Community action in the field of Health and Consumer Protection 2007-2013, COM (2005)115

3.1. Use of Instruments of Collaborative Research

The regular instruments of collaborative research offer an appropriate means of providing financial support for the implementation of the Strategic Research Agendas of European Technology Platforms for the following reasons:

- the criteria that have guided the identification of the **domains for thematic research** in the Commission's proposal for the Seventh Framework Programme - contribution to EU policy objectives, European research potential and European added value - **fit well with the aims of European Technology Platforms**;

- the "bottom-up" nature of European Technology Platforms provides a strong basis for identifying thematic priorities with **broad stakeholder endorsement**;

- the Strategic Research Agendas of platforms can help ensure that research topics supported under the Framework Programme are **coherent with the needs of stakeholders**, and industry in particular;

- the dynamic process by which Strategic Research Agendas are defined in platforms can inject new impetus into collaborative research, providing **additional input to a policy-based priority-setting process**;

- European Technology Platforms are not limited to a sectoral approach but have the capacity to **identify cross-cutting research challenges**;

- European Technology Platforms can play a valuable role in **disseminating the results of EU-supported research** to the relevant industrial and other stakeholders.

Accordingly, in formulating the research themes for the Seventh Framework Programme, the broad research needs of European Technology Platforms are **well reflected across the nine research themes** set out in the Commission's proposal for the Seventh Framework Programme. Their more detailed technical content will be taken into account, as appropriate, when formulating the Specific Programmes and subsequently in the Work Programmes for calls for proposals.

3.2. Joint Technology Initiatives

Joint Technology Initiatives involve a dedicated legal structure to implement a clearly defined objective. They can, therefore, serve to implement a specific part or the entirety of a European Technology Platform.

The objectives of Joint Technology Initiatives include the following:

- ensuring **coherent implementation of European research efforts** in the strategic technological fields for the future;

- **accelerating the generation of new knowledge**, innovation and the uptake of research into strategic technologies, leading to enhanced productivity and strengthened industrial competitiveness;

– concentrating efforts on key projects that can help **meet Europe's industrial competitiveness goals**;

– **enhancing the technology verification process** in order to identify and remove obstacles to future market penetration;

– pooling user requirements to guide investment in research and development towards **operational and marketable solutions**.

Notwithstanding state aid rules, Joint Technology Initiatives allow funding from the Framework Programme to be combined with other public funding sources, including, where appropriate, the Structural Funds. This, in turn, can have a significant leverage effect on private investment in Joint Technology Initiatives and related economic activity.

At the same time, Joint Technology Initiatives are not intended to have a restrictive effect on competition. They are designed to enhance downstream competitiveness in key technologies by addressing market failures arising from the high costs and risks associated with long-term, pre-competitive, multidisciplinary research.

4. IDENTIFICATION AND IMPLEMENTATION OF JOINT TECHNOLOGY INITIATIVES

4.1. The Identification Process

To identify the European Technology Platforms for which the Strategic Research Agendas suggest the need for a Joint Technology Initiative to be set up, a **thorough and rigorous identification process** must be carried out. The Commission has no intention of using this process to engage in a "top-down" selection exercise. Rather, the purpose is to ensure that identification is objective and rigorous and, in this way, enhance the credibility of Joint Technology Initiatives as an innovative mechanism for supporting industrial research.

State aid rules will apply, in particular rules on state aid for research and development. The Commission services note that possible risks to competition should be reduced in this context.

Reflecting the Commission's proposal for the Seventh Framework Programme, the identification process involves **applying successively a series of criteria** under the following headings:

– strategic importance of the topic and presence of a clear deliverable;

– existence of market failure;

– concrete evidence of Community value added;

– evidence of substantial, long-term industry commitment;

– inadequacy of existing Community instruments.

4.1.1. Strategic Importance of the Topic and Presence of a Clear Deliverable

An essential justification for a Joint Technology Initiative is that it makes a **unique contribution to Europe's industrial competitiveness in strategic technologies**. The first set of identification criteria focus on the strategic importance of the topic as follows:

– The initiative addresses a technological challenge that will **impact significantly on Europe's future** competitiveness capabilities. In this regard, the Strategic Research Agenda represents the **acquisition of new knowledge in advanced technological areas**.

– The initiative offers scope **for giving Europe a critical competitive advantage** in the development of new strategic value domains and increasing Europe's future growth potential. For example, a pan-European approach may be necessary to **combat the threat of delocalisation** and may offer the prospect of making Europe more attractive for inward investment in research.

– The initiative offers concrete prospects of generating **new value-adding economic activity or more efficient existing activity** (e.g. new or improved products, services or demonstrators) leading to a clearly defined deliverable. There will also be **multiple users of the technologies** to be developed with the potential to positively affect major and strategically significant European industries.

4.1.2. Existence of Market Failure

The second set of criteria is intended to establish whether a market failure exists which would **prevent or hinder the optimum development of the technological area** in question. Market failure can take a variety of forms, of which the following are significant for research and industrial policy:

– There is a **higher level of risk** or **longer investment period** involved than is acceptable to industry or to the financial community.

– The technology challenge involved can only be met effectively if a number of investments are put in place as part of a **co-ordinated approach**.

– Significant **externalities,** both positive (e.g. significant impact on sustainable development) and negative (e.g. lack of integration of social and environmental costs) are likely to arise, and, consequently, while the direct benefits of application of the technology will derive only limited commercial benefits, the **"spill-over" effects to other areas and to wider society will be positive**.

4.1.3. Concrete Evidence of Community Value Added

The Council has laid down the **necessity for complementarity** in relation to Community funding. Accordingly, the third set of criteria addresses the need for Community added value as follows:

– Implementation of the Strategic Research Agenda requires the **achievement of a critical mass** that goes beyond the capacity of individual Member States. This critical mass can relate to the level of financial commitment involved or the research capacity required.

– **Community funding will be made more effective** due to an increased leverage on private investment and national public funding. This can be achieved through more effective use and combination of financing instruments (grants, fiscal incentives, guarantee mechanisms and support to risk capital)

and considerably strengthened links between private and public research efforts.

– **Community instruments play an important role** in facilitating effective implementation of the Strategic Research Agenda, in particular where it is in line with related policies, notably by ensuring adequate legislation, standards and public procurement procedures. In some cases, it will be necessary to put in place appropriate arrangements regarding intellectual property rights.

– **Community policy objectives** in areas such as health, safety, environment and consumer protection will be facilitated by a co-ordinated approach at European level and greater co-operation between public and private players**.**

4.1.4. Substantial, Long-Term Industry Commitment

To justify the setting up of a Joint Technology Initiative, the sustained, long-term commitment of industry is paramount. In this regard, the following criteria are applied:

– There is **demonstrated commitment from industry** to provide high levels of sustained financial and human resources and to ensure that large companies interact effectively with appropriate networks of small and medium-sized enterprises.

– Appropriate steps have been taken to ensure **openness and transparency** with regard both to existing and new stakeholders and to the communication, dissemination and diffusion strategies put in place.

– The **outputs expected are clearly identified and concrete** and are the subject of a deployment strategy and, where appropriate, of a comprehensive, technologically and economically rigorous business plan.

– **Clearly defined roadmaps** have been formulated, each with realistic and measurable milestones and deliverables, while at the same time recognising the need for flexibility to take account of rapidly evolving technologies.

– **Technical, legal, financial and managerial frameworks** have been identified (consortia, public-private partnerships), as well as any existing research infrastructures which need to be utilised or any new ones which need to be created.

4.1.5. Inadequacy of Existing Instruments

The final and critical justification for setting up a Joint Technology Initiative is the inadequacy of existing funding instruments. Accordingly, essential criteria to be met are the following:

– There is clear evidence that **existing instruments and structures (and notably those of the Framework Programme) would not achieve the desired outcome**, since they would not allow sufficient co-ordination and synergies nor guarantee the prior commitment of other funding bodies or partners (particularly industry and Member States) to long-term continuity.

– The **scale and scope** of the Strategic Research Agenda are so ambitious that they extend significantly beyond the timescale of a single Framework Programme.

4.2. Possible Joint Technology Initiatives

Given the current stage of development of the Strategic Research Agendas of the European Technology Platforms, the Commission has identified **six areas where a Joint Technology Initiative could have particular relevance**[9]. As recognised in the Commission's proposal for the Seventh Framework Programme, other possible themes could be identified subsequently through the work of the European Technology Platforms. Such proposals would then also be assessed against the above criteria.

4.2.1. Hydrogen and Fuel Cells

Securing a long-term, independent energy supply is an important goal for Europe. In this context, hydrogen and fuel cells technologies represent an area of significant strategic importance. They can give Europe a significant competitive edge by bringing about a **paradigm shift in the way energy is produced and used**. They can thus contribute to creating dynamic and competitive energy and equipment industries.

These technologies do, however, involve substantial **externalities** in that they offer significant potential to secure sustainable energy supply and reduce greenhouse gas emissions. At the same time, the transition to a hydrogen economy implies high capital investment. However, the risks are so high and the benefits currently so uncertain that **market forces alone will not be sufficient** to bring about the hydrogen economy. To address this challenge successfully, the development of new technologies is required, supported by mechanisms to move these closer to the market. A co-ordinated approach across different sectors is called for to create new supply chain structures and develop coherent transition strategies. Therefore, a long-term public-private partnership approach is necessary to address these market failures effectively.

The scope for **European value added** is also evident. The technology challenge is of substantial complexity and scale and is hindered severely by the dispersion of technical competencies. It must, therefore, be tackled in a focused way and on a European scale in order to achieve critical mass in terms of level of activity, excellence and potential for innovation.

There is a high level of **sustained industry commitment** to the effort. Since the launch of the European Technology Platform on this topic, more than 200 stakeholders have contributed in excess of 2000 person-days to setting it up. At the end of 2004, the stakeholders endorsed the Strategic Research Agenda, together with the associated Deployment Strategy, and reaffirmed their commitment to working together. Future commitment from industry is likely to be defined in terms of specific in-kind resource investment. In this context, the involvement of end users (for example, the automotive industry) can play an important role.

A Joint Technology Initiative is essential to create the necessary **long-term public-private partnerships so as to develop and apply technologies** and guide future large-scale investment decisions in relation to infrastructure as well as new production plant and equipment. It is also necessary to build the necessary interface between the European,

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[9] Commission Communication on Building the ERA of knowledge for growth, COM(2005) 118 of 06.04.2005

Member State and regional levels in order to integrate and co-ordinate research efforts as well as to facilitate coherent policy and regulatory frameworks for deployment.

This platform is already looking ahead to potential **concrete deliverables** in terms of a new generation of prototypes and demonstrators for testing and validation in the fields of transport, stationary and portable applications. The Joint Technology Initiative will ensure that efforts under the Seventh Framework Programme for Research and Development build on existing actions and establish a technology development portfolio aligned with business objectives and investment cycles. The overall aim is to create an industrial base at European level able to compete globally and capitalise on future opportunities for new job creation and economic growth.

4.2.2. Aeronautics and Air Transport

Aeronautics and air transport industries and service providers are **powerful drivers of innovation** in the economy as a whole. They make stringent demands on their products, requiring simultaneously safety and reliability, low weight, good economics and minimal environmental impact, enhanced power and efficiency. The technologies developed for aeronautics products, systems and services also provide spin-offs to many different sectors. Europe must remain at the forefront of key technologies if it is to have an innovative and competitive aeronautics industry in the future.

Aeronautics also integrates and promotes the development of a wide range of skills, processes and technologies vital to maintaining a broad-based and prosperous economy. Prime manufacturers depend on a network of second- and third-tier specialist companies to meet their needs. These firms, operating at many different levels of the industry, are **home to the key technologies essential for Europe's future**.

Aeronautics is a highly capital-intensive industry investing for the long term. The level of investment in research and technology, product development and capital facilities as a proportion of turnover for airframes, engines, ground and airborne equipment exceeds that of many other industries. At the same time, **returns are inherently long-term and high risk**, which restricts the interest of the financial markets. As a result, public support for research and development has become an essential feature of the business world-wide. Without strong public commitment, **positive externalities**, such as for the environment, could not be realised.

Against this background, a Joint Technology Initiative would contribute strongly to the implementation of the Strategic Research Agenda for Aeronautics in Europe by addressing advanced technologies and fostering such aspects as their integration, large scale validation and demonstration in a coherent and self consistent programme of work, allowing to reach the **scale effect and continuity of purpose** to enable research results to reach implementation not achievable through collaborative research. In the field of sustainable air transport, two Joint Technology Initiatives are envisaged to be launched in the early stages of the 7th Framework Programme. These will be in line with the recommendations of the Strategic Research Agenda, one addressing areas such as environmentally friendly ("green") and cost efficient aircraft. The other one on air traffic management will be in support of the Single European Sky policy and SESAME Initiative of the European Commission. Both will contribute to achieving a more sustainable, coherent and optimized future air transport system in Europe.

As an RTD-intensive industry, the existing competitiveness of European companies in world markets has been built on significant private research investments (typically 13-15% of the turnover) over many decades. The development of the Airbus A380 super-jumbo is a prime

example of such undertaking. Aerospace companies and their shareholders are prepared to make **significant long-term investments** in order to secure the industry's long-term competitiveness.

Given the specificities of the aeronautics sector, new developments often depend on effective cooperation between the public and the private sectors. The Single European Sky ATM Modernisation Programme (SESAME), based on the master plan for a European air traffic management system, currently under preparation, is a good example of this. Accordingly, the development of the organisational framework for long-term public-private partnerships is a natural step forward, allowing both sides to make the long-term commitments necessary to facilitate significant investments by all parties involved. The long-term and programmatic nature of the investment now required in the sector makes the **normal instruments of the Framework Programme sub-optimal** for this purpose.

Potential **key deliverables** are, for example, demonstrated technologies and concepts for environmentally-friendly, cost efficient aircraft and advanced technical solutions to bring about a harmonised air traffic management system in order to implement Europe's "single sky" policy.

4.2.3. Innovative Medicines

Public understanding, support and involvement are prerequisites for a solid scientific base in the pharmaceutical industry. In particular, clinical trials require high participation rates if they are to be conducted efficiently and effectively. Greater transparency in the evaluation of medicines, publicly accessible trial registers and public involvement in trial design, implementation and assessment are necessary to improve public understanding in this area.

Technological development in the pharmaceutical industry in Europe is currently hindered by lack of co-ordination between public and private research investment in specific pre-competitive areas across the drug development process. This **market failure** can be overcome through a long-term public-private partnership that creates critical mass and synergies.

A Joint Technology Initiative offers the prospect of giving the industry in Europe a **competitive edge** by overcoming the current bottlenecks in the pre-competitive phase of the drug development process, notably prediction of safety, prediction of efficacy and knowledge management, as well as education and training.

The initiative aims at developing tools to facilitate the rapid **translation of research results into proven therapies**, positively affecting all therapeutic areas, including those where unmet medical needs have been identified, as, for example, in the Priority Medicines Initiative.

Community **value added** arises in that it is only by pooling the necessary resources and competencies of all parties involved at European level that a real change can take place. The complexity, nature and scale of the work involved make a European-level response essential.

Industry commitment has already been demonstrated by the allocation of key personnel and resources to this task on the part of all pharmaceutical companies active in Europe. The pharmaceutical industry in Europe has now backed this up by an explicit commitment to the implementation of the Strategic Research Agenda. If this commitment is to lead to significant progress, all parties must dedicate themselves to the process on a long-term basis.

To meet the technological challenge set out in the Strategic Research Agenda, a paradigm shift is required in the way research is conducted in this sector. Long-term commitment,

coupled with pooling of resources and competencies, is the only way of addressing effectively the complex nature and the scale of the challenge involved. The existing instruments of the Framework Programme cannot cater for the **long-term nature of the challenge** or the necessary pooling of resources.

The potential **key deliverable** of this initiative is reduced drug development time and clinical attrition rate. This aims at ensuring that patients have faster access to more targeted medicines with fewer side effects. At the same time, it will provide industry with a more rapid return on investment and hence leverage increased private investment.

4.2.4. Nanoelectronics Technologies 2020

Nanoelectronics is of **high strategic importance for European competitiveness** because its products are key enablers for innovation in other sectors (multimedia, telecommunications, transport, health, environment, industrial processing, etc.). It requires that R&D and innovation efforts be better structured, optimised and integrated into a larger process involving all actors crucial to achieving a successful outcome in the domain. This is particularly important as this field has to face extremely rapid and challenging technological developments and strong global competition with increasing levels of investments.

In order to strengthen its position in the global nanoelectronics sector, particularly in the face of increasing competition notably from Asia, it is **essential for Europe to increase investment** in research and development in order to keep abreast of shrinking size in the most widely-used technologies. In parallel, there is a need to invest in next generation technologies to ensure a leading position in this rapidly evolving industry.

However, efforts in this direction are currently hindered by **market failure arising from the fragmentation of the research landscape** in Europe. Overcoming this will deliver the scientific knowledge and industrial expertise needed to master the future development of nanoelectronics in Europe, while at the same time developing complementary poles of competence around an integrated and co-ordinated research infrastructure.

Community value added is demonstrated by the potential it offers to overcome the fragmentation of nanoelectronics research in Europe.

The European nanoelectronics industry has already demonstrated its long-term commitment to this end. Together with Member States, it has **signed up to a public-private partnership** towards achieving Europe's long-term economic and social goals.

A Joint Technology Initiative would **provide the necessary legal, contractual and organisational framework** to better structure the specific joint commitments to which stakeholders are ready to sign up. A Joint Technology Initiative would also offer the prospect of providing the visibility required to implement successfully the demanding roadmaps guiding the application of the future components that underpin a wide range of industrial sectors.

The **regular instruments of the Framework Programme are insufficient** to meet the scale of the challenges facing the European nanoelectronics industry in the coming years.

The **key deliverable** of this initiative will be to develop the capabilities of nanoelectronics in Europe through the creation of an attractive R&D and human capital environment for investment.

4.2.5. Embedded Computing Systems

Embedded computing systems – the invisible electronics and software that impart intelligence to products and processes – represent a **topic of strategic importance** because they underpin the competitiveness of key areas of European industry, including automotive and avionics, consumer electronics, telecommunication devices and equipment and manufacturing automation.

The enormous technological challenges for embedded systems arise from the lack of a systematic approach and associated engineering methods to support the design of electronic and software systems of high complexity and the absence of a *lingua franca* that would allow diverse electronic devices and systems to "talk to" and "understand" each other. Furthermore, the current structure of European industry does not provide the necessary framework in which to develop the key enabling technological components and tools. As a result, research costs are too high and associated risks too great.

Substantial value added can be realised by a European-level approach that would overcome the current fragmentation of research efforts and address the need for world-leading centres of excellence, coupled with appropriate education, skills development and standardisation regimes. In this regard, public support is crucial in order to share the high risks, maintain a high level of ambition and leverage private investment.

Industry has already demonstrated its commitment by investing significant resources in developing the European Technology Platform to its current state. Further commitments "in-kind" and of own resources have already been made with the aim of building sufficient critical mass to pursue the objectives set and, in particular, to make research and development more efficient and effective.

The **regular instruments of the Framework Programme alone cannot bring together the necessary scale of resources** and expertise to meet the investment challenge in relation to embedded systems. A Joint Technology Initiative will offer the necessary legal and organisational framework to ensure long-term commitments from all stakeholders and allow the Strategic Research Agenda to be implemented in a seamless manner across Europe. In addition, such a public-private partnership provides a platform to achieve co-ordination of funding from the Framework Programme, EUREKA and national funds.

A **key deliverable** of this initiative will be the development of the building blocks that will underpin the **emergence of new markets and societal applications** of ambient intelligence.

4.2.6. Global Monitoring for Environment and Security (GMES)

The objective of GMES is to provide **geo-strategic information** that can be used in a number of **policy areas of priority at both European and Member States levels**. GMES must respond to the political mandate set out in the Council Resolution on GMES following the June 2001 Gothenburg Summit which stresses that "the Community should contribute to establishing by 2008 an operational capacity for global monitoring for environment and security (GMES)"[10].

[10] Council Resolution 2001/C 350/02 of 13.11.2001

The European Commission has established an Action Plan for GMES[11]. In practice, GMES will provide geospatial information in generic form and as customised services, based on the coordinated integration of space and in-situ observations as well as existing data in maps or other geo-referenced data repositories (socio-demographic statistics, etc.).

The next phase of development of GMES depends on the sustained availability of user-oriented services in a large number of application areas. This, in turn, relies on significant investments in related infrastructures such as Earth Observation capacities from both space and in-situ. At least in the initial phase of implementation of operational services, such investments, as well as the initial users, must come primarily from the public sector.

The **private sector** will have an important role to play as providers of GMES services and suppliers of data. The private sector, including small and medium-sized enterprises (SMEs), will, in fact, develop a market based on GMES services and infrastructures which will be encouraged by a Joint Technology Initiative.

Europe needs autonomous capability based on a **European standard for global monitoring**. This will help Europe and its industries considerably in this highly competitive area, where, for instance, the US is investing heavily in the development of its standard for global monitoring systems. Europe is still working with national capacities and thus national standards. In order to match the US efforts, in particular within the international context of GEOSS, it is necessary to put an adequate European system in place.

The development of GMES depends on the **co-ordinated use, under a unique management responsibility**, of both a very wide spectrum of input data and a large number of service delivery systems, in accordance with clear standard and validation criteria. Without a critical mass of input data, service delivery systems, and, above all, **committed users** in many inter-related application areas, the costs of GMES would be significantly higher. At the same time, the quality of its services would remain significantly below the threshold of competitiveness that would enable them to assure long-term sustainability and a large user uptake. This points to a close involvement and participation of user organisations within a Joint Technology Initiative for GMES, at both national and European levels.

GMES is an essential investment for European infrastructure, closely linked with Community policies and having significant commercial potential. Its services will be capable of delivery through active involvement of the private sector, including SMEs. It will give Europe leadership in an area of management and use of major infrastructures, including strategic space capacities. It will also provide a basis for a more intelligent exploitation of finite natural resources by both public and private entities. It will, thus, help to **improve productivity in many sectors** which have a need for coherent and up-to-date information on available assets.

4.3. Joint Technology Initiatives: Implementation

The diversity of the potential Joint Technology Initiatives means that **structures must be tailored** to the nature of the technological challenge to be addressed, the characteristics of the relationship among the stakeholders and the financing needs of the initiative.

At the same time, in determining the most appropriate structure, certain guiding principles should be respected. The structures put in place must **ensure the efficiency and durability** of

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[11] "Global Monitoring for Environment and Security (GMES): Establishing a GMES capacity by 2008 - Action Plan (2004-2008)", COM(2004) 65 of 03.02.2004

the Joint Technology Initiative so that the desired outcome is achieved. They must also **support the long-term commitment** of the various stakeholders - notably of industry, but also of public authorities. While allowing the stakeholders in the Joint Technology Initiative a significant degree of autonomy in relation to the implementation of research activities, the structures should **promote transparency, co-operation** among existing stakeholders and **openness** to new stakeholders who could add value to the endeavour, while also avoiding creating conflicts of interest. Moreover, it is appropriate that, where a suitable structure already exists, this should be utilised to support a Joint Technology Initiative.

Work is ongoing in the Commission services in relation to possible implementation structures for Joint Technology Initiatives. Two options are emerging that may offer the necessary combination of adaptability and co-ordination. The first would involve the Community itself setting up a dedicated structure on the basis of Article 171 of the Treaty. The second would avail of a number of other possible legal options, involving the use of either a structure specially set up for the purpose or an appropriate existing structure.

4.3.1. Application of Article 171 of the Treaty

Article 171 of the Treaty[12] offers a **wide range of possible implementation structures** for Community research and development programmes, of which the most prominent is a Joint Undertaking. The main advantage of a **Joint Undertaking**[13] is that it creates a strong and efficient coordination mechanism, able to structure and handle contributions coming from different fields and sectors.

4.3.2. Use of Other Possible Legal Options

A range of other possible legal options could be availed of, involving either a structure set up for the purpose or an existing structure. Use of these options would lead to implementation through the normal funding schemes of the Seventh Framework Programme.

A **European Economic Interest Grouping**[14] may be appropriate in certain cases because it involves relatively straightforward implementation procedures for stakeholders. A **Non-Profit Organisation** (e.g. an Association or a Foundation) also offers advantages because it generally works on the principle of "one member, one vote" and so facilitates active participation of all stakeholders. A further possibility is a **Commercial Private Company**, involving the formation of an enterprise, generally with limited liability.

Where an appropriate dedicated structure already exists, the Commission could provide a grant to this dedicated structure.

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12 "The Community may set up joint undertakings or any other structure necessary for the efficient execution of Community research, technological development and demonstration programmes."

13 Although the application of Article 171 to the concept of the Joint Technology Initiative is novel, there are a number of examples where Article 171has been used to set up joint undertakings in the research field, including, notably, Galileo under EC rules and JET in the framework of EURATOM.

14 A European Economic Interest Grouping is a legal entity based on Community law to facilitate and encourage cross-border co-operation. Its purpose is to facilitate or develop economic activities by pooling resources, activities or skills.

5. CONCLUSION

In the context of the revamped Lisbon strategy, **Europe must develop a new momentum** to realise the competitive dynamism it requires to take its place in the vanguard of the global knowledge economy and society.

European Technology Platforms are already demonstrating their potential as a mobilising force for converting aspirations into action. Joint Technology Initiatives, based on broadly-based, long-term public-private partnerships, can become **flagship projects** for a more dynamic and competitive European industry and economy.

The Commission has presented a **comprehensive range of identification criteria** for Joint Technology Initiatives. Based on the information currently available, six possible Joint Technology Initiatives have been put forward in connection with the Commission's proposal for the Seventh Framework Programme. Others may be proposed later.

On this basis, the initiative now lies with the relevant industries and with Member States. It is for the leaders of the industries concerned to build a case to demonstrate that the Strategic Research Agendas that have been developed meet the detailed criteria for a Joint Technology Initiative and that their implementation will lead to concrete deliverables that will impact positively on Europe's industrial competitiveness, so contributing to growth and sustainability. In this regard, a definite commitment is required with regard to the exact definition of projects, their financing and the putting in place of the necessary structures for their effective implementation.

Member States are invited to endorse these developments. They are asked to reflect on the extent to which they can join the Commission in developing further the concept presented with a view to setting up public-private partnerships in R&D to boost industrial competitiveness in the form of Joint Technology Initiatives.