Enhancing Technological Research in the field of Key Enabling Technologies (KETs).

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Working Group 3 Report
Sherpas to the High Level Group
2011 High Level Group on key enabling technologies

Executive summary

Today, Europe is still strong in scientific research and in the development of technologies. In particular, Europe has a strong knowledge base, skilled work force, strong Research and Technology Organisations (RTOs) and a healthy environment of small and medium size businesses. In general, the status of key enabling technologies (KETs) in Europe is fine. However, to remain competitive on the global scale, Europe must do better. It must gain or defend leadership in those technologies that are key for innovation and it must develop a clear focus on bridging the gap between knowledge and markets. KETs promise high-tech solutions to several of the societal challenges facing Europe and underpin major European industries. Europe needs a pan-European coordination of its efforts to create critical mass and impact in the field of Key Enabling Technologies. Vital aspects a coherent European-size support program for KETs must tackle are:

- Europe needs faster mechanisms of dissemination - of scientific findings, of applications, and of technologies - and of production capacity.
- Europe must overcome its fragmentation by integrating support for KETs over the entire value chain
- Europe must simplify its collaboration rules and facilitate industrial participation.
- Europe must improve its IP exploitation of research results and focus on European benefits – Europe first.

This working group makes five major recommendations to the European Commission how to support the development of KETS in the European Union and translate that into innovative products and services.

1. Create a European Innovation Council of high level stakeholders across the entire innovation chain. Include industrial leaders, entrepreneurs, policy makers and technology experts (including scientists) to continuously monitor the progress in Europe towards the goals of the Europe 2020 Strategy and the various flagship initiatives, such as the Digital Agenda and the Innovation Union.
2. Create a large KET support program across Commission Services remits to support collaborative development and deployment. This program must address the entire innovation chain, i.e.: must include large-scale validation of technologies (LSVPs), technology-driven strategic research alliances, and market-driven public private partnerships (PPPs).
3. Create a European Technology Research Council (ETRC) to promote excellence in technological research and innovation in a European-wide competition, similar to what the ERC does for pioneering research. Here the goal is to add relevance and impact to excellence and bring European value to innovation projects complementing regional and national actions.

4. Create a fresh set of clear rules for funding research for innovation, geared at relevance, focused on results and professional management – General guide lines for research-for-innovation in Europe and how to bench mark it.
5. Create a "globally competitive" IP management to ensure the acceleration of IP deployment for production and business in Europe. All instruments should have pre-defined rules of Deployment in Europe first – if the results were publicly funded in Europe. All Technology proposals should contain an IP exploitation plan illustrating a "in Europe first" policy.

Technological research-for-innovation must focus on one direction: moving across the "innovation bridge" towards relevance and impact on the market. Prototyping, first demonstrators, and projects for competitive production are all be necessary to keep Europe globally competitive. Europe needs to make "smart" decisions after prioritization. To promote KETs in Europe in line with the first stage horizontal analyses and the mid-term report[1] is more complex than funding blue skies research.

[1] High Level Group Key Enabling Technologies Md-term report to the Euroepan Commssion, 9.February 2011.

0. Introduction

Key enabling technologies (KETs) as defined through the European Commission:

- are research & development-intensive
- are capital-intensive
- require a highly-skilled work force
- are subjected to rapid innovation cycles.

Due to their multi-disciplinary and trans-sectoral characteristics and their trend to convergence and integration at the industrial deployment level they are often emerging and converging technologies.

This working report analyses horizontal aspects of KETs and how to enhance their innovative output. Six key enabling technologies were chosen, microelectronics, industrial biotechnologies, nanotechnologies, photonics, advanced materials and advanced manufacturing. Tasks are to identify commonalities restricting the deployment of KETs in Europe and to make recommendations how to enhance technological research in their fields and how to enable subsequent stages of "proof of concept" demonstrators and a large scale deployment for production in Europe.

The previous stage of work by the High Level Group on Key Enabling Technologies contained vertical analyses of KETs and extracted commonalities. In the mid-term report a picture was sketched containing a "valley of death" between applied research and the production "ramp-up" stages after prototyping. This gap in the innovation chain was identified to be specifically severe (i.e.: wide) in Europe. A so-called three-pillar-bridge was suggested as a way forward. Pillar 1 addresses how to enhance technological research (this working group 3). Pillar 2 addresses how to facilitate pilot lines, demonstrators and prototyping (working group 4). Pillar 5 addresses how to stimulate large-scale production in Europe. This "three-pillar-bridge" is also referred to as the "KET innovation bridge".

Excellent Technological Research distinguishes itself by

- being excellent
- being relevant
- having strong impact potential

To address these item distinguishes excellent technological research from fundamental research. Budgets are limited by principle. Obviously, to enhance Technological Research European-wide programs will need to leverage other financial sources: private/commercial funding including venture capital schemes, national funding and regional funding. Funding at the European or global level must add the "European value", i.e.:

- create critical mass and overcome fragmentation (coordinate Europe-wide)
- stimulate transnational collaboration in Europe (create a fundament for synergies)
- encourage deployment in Europe.

Any new tool in the CSFRI to enhance technological research must look for the maximum leverage effect and this must be a continuous assessment of success.

1. Key enabling technologies: high-tech opportunities for Europe.

Key enabling technologies are state-of-the-art cutting edge technologies that are based on "high-tech" applied research. KETs are crucial components of high-tech production industries. They have the potential to innovate Europe's industrial-technological basis, to create sustainable and globally competitive production industries and to create new business models and jobs. KETs are distinguished by their potential to transform or disrupt business in Europe.
The European Commission has proposed a Common Strategic Framework for Research and Innovation (CSFRI) to merge and integrate actions previously in separate FP, CIP and other programs of relevance for Research, Development and Innovation. Common focus is to align actions to serve the Europe 2020 Strategy and tackle the so-called "Grand Challenges" the European society is facing. Key enabling Technologies underpin the solutions sought and are pivotal in triggering innovation in a wide range of technology fields and global markets. Any program dedicated to Innovation will have to add relevance and impact of the aspired solutions to the criterion of excellence. All three are prerequisites for success.
The CSFRI must in a first step enable this new "relevance and impact-driven" view on applied research in Europe.
Until now Europe Framework Programs have focussed far more on fostering fundamental research. The Framework Programs of the European Commission were by far more concerned with creating conditions and rules for researchers to cooperate with each other across borders in Europe, regardless of the currently more substantial yet very different National funding schemes in individual member states. This created a situation in which research did not focus on generating returns.

2. Set of general findings

The working group has identified that in Europe:

- translation of science to technological research and innovation is too slow and not prioritized to the same extent as science is generated.
- transfer of technologies from applied research to the market is too slow
- industrial participation in the dissemination of technologies is too low due to absence of suitable support mechanisms
- only a few actors and stakeholders actually have an "innovation chain consciousness", i.e.: are actually engaged along the entire innovation chain or align their activities with the needs of other partners covering different stages of the innovation chain.
- existing IP rules and regulations do not promote an exploitation on European territory. Most often, European programs do not require or even foresee an

implementation plan to ensure a first exploitation in Europe. This is, for instance, in sharp contrast to the situation in the US where the Bayh Dole act enforces an "America first" exploitation of IP derived from publicly funded actions (see case study: Bayh-Dole act).
- Existing EU programs to support the development of technologies and industrial participation have become increasingly risk aversive.

In result industrial-private participation in past Framework Programs has decreased from 39% in FP4 to merely 25% in the current FP7. This decrease is correlated to the recent emergence of various initiatives, such as Joint Technology Initiatives (JTIs), Public Private Partnerships (PPPs), European Technology Platforms (ETPs), "Article 185ers", Lead Market Initiatives etc. In result most of these FP 7 Initiatives are currently underspending available EC funds. There is room for improvement and a coherent Europe-wide plan to enhance the deployment of Key Enabling Technologies will have a leveraging and streamlining effect on the follow-up activities of FP 7 initiatives:

Strategic support for KETs should take into account the following needs:
- **Europe needs an Innovation Council**: Validation of the innovation-benefits of any new measure as well as an established continuous control system will be needed to guarantee the successful alignment of the CSFRI, and any support for KETs, with the goals of the Europe 2020 strategy, the Innovation Union Flagship and any other European-scale initiative. A High-Level Group of industrial leaders and entrepreneurs, researchers, and government officials should assess and report on the progress on the innovation strategy - in particular, on the benefits of any measures designed to foster the development and subsequent deployment of KETs at the European level
- **Europe must leverage critical mass, in particular by maximizing and exploiting the impact it's Research and Technology Organisations (RTOs) already provide**: European programs should focus on leveraging technological development - not just on funding it. Europe can easily amplify existing R & D potentials at the Member State level through dedicated coordination measures. I.e.: CSFRI must include means to forge strategic research alliances of major national technology creators such as the existing Research and Technology Organisations (RTOs). At the member state level these organisations already serve the industrial sectors, operate PPP business models, and have best practices in place for technology enhancement that can be levered to a pan-European level through smart, specifically targeted programs.
- **Europe needs to include more industry**: we need focussed and public-private partnerships (PPPs) that cover the entire innovation chain. These are industry-driven and must be vehicles of "market-pull". They must be flexible in governance and management and variable in size. Some should include SMEs, others should include larger companies. The actual form must be flexible, project agendas must be clearly determined by industry, yet with a transparent standardized governance scheme. PPPs must guarantee fair participation, IP

rights management while maintaining the necessary confidentiality, i..e.: Europe needs faster and more cost-effective PPPs.

- **Europe needs to stimulate, develop and nurture new generations of excellent engineers and technologists as well as basic scientists.** The ERC program should be maintained with its single goal of excellence. However, the definition of excellence should include both scientific **and** technological research excellence. Technological research excellence is characterized not by its curiosity-drive, as is basic research, but rather by the addition of relevance and a transformative, or disruptive, character. This adds complexity and requires dedicated expert boards familiar with KETs.
- **Europe needs stronger local clusters and Technology Validation Platforms:** innovation-driven consortia with business models focussed on industrial transfer in an SME environment. This is an effective first step in technology validation or technology readiness level (TRL[2]) enhancement. Technology Validation Platforms – or Technology Research Platforms - forge a service-oriented local "technology infrastructure" in which research services and technological development can be carried out in a shared environment including real-world production settings. TVP business models are based on sharing technology tests with industrial partners quickly in the local cluster. This requires **dedicated funds for Technology Validation Platforms as Infrastructures for Technological Research** to align activities between academia, RTOs and industrial pilot lines and lower the barriers in technology transfer in Europe. .Additional process tools and characterization equipment are needed to create a continuous transformation of technological achievements between RTOs and industrial pilot lines. in order. Common design rules are prerequisite for a fast and bi-directional transfer of results.
- **Europe needs to foster cross-border technology cooperation:** National organisations that enhance technologies must be given adequate opportunity to combine and integrate their services and link themselves to existing regions of technology leadership elsewhere in Europe. National technology organisations must be enabled to “go European”, i.e.: to create outposts and co-locations to combine their own services to create Technology-Infrastructures and service. This increases Europe's knowledge base and accelerates the creation of new technology demonstrators and production capacity.
- **Europe needs an IP policy that pro-actively promotes and accelerates innovation and manufacturing in Europe.** Management of KETs developed through public funding should be based on common rules, similar to those contained in the Bayh-Dole act in the US to promote the deployment of KETs in Europe. Emphasis should be two-fold: guarantee flat and fair regulations across

[2] TRL: Technology Readiness Level, see also: http://www.cttso.gov/techtrans/TRLDefintions.pdf

Europe for all partners at the public-private interface while ensuring a European benefit in the ownership and deployment of intellectual property *made in Europe*. European technology development programs should enforce an exploitation plan focussed on achieving a European-added value, i.e., IP exploitation should by default be in Europe or else require specific justification.

3 Five Major Recommendations

Fundamental research is curiosity-driven. It seeks for the right question to describe phenomena. Outcome is non-critical, unpredictable and open.
Technological research is result-driven. It begins with a vision - the desired end – the answer to a societal demand, a new product or service. Outcome is extremely critical, can be benchmarked although not guaranteed. Progress must be carefully monitored.

Technological research within the current report may be distinguished from other activities as technology demonstration or pilot line activities by using so-called Technology Readiness Levels (TRL). While this scheme has some limitations in the framework of modern innovation theory - mainly because of its linearity and its tendency to think in terms of technology-push rather than market-pull - it may be used as a simplified guideline. In terms of TRL and in the understanding of this working group, technological research (i.e., pillar 1) covers at least levels 1-5 where level 1 is typically covered in the sector of "knowledge creation", i.e., to the left of the KET innovation bridge, while there is also some overlap with higher levels.

3.1 A European Innovation Council (EIC) should be established as a high level board overseeing the CSFRI with a focus on innovation.

CSFRI as an integrated framework to support the Innovation Union will need a high level strategy board to monitor the progress of all strategic measures and instruments, to advise the Commission on the implementation of strategies, and to foster the alignment of innovation policies across sectors. The necessity to focus on innovation, the relevance and impact of technologies requires a council other than a science-oriented board, such as ERAB. A European Innovation Council (EIC) must be composed of European-minded, eminent industry leaders and entrepreneurs, and heads of leading technology research institutions and organizations. The board would have the mandate and means to create dedicated working groups to address sub-topics or carry out studies on progress and effectiveness of individual tools. The European Innovation Council can also deliver independent implementation standards, e.g., concerning an output-oriented management of innovation programs.

3.2 The CSFRI should contain a dedicated KET-support program to enhance technological research across Europe in areas relevant for the competitiveness of European industries.

Likewise, any new measures to support the enhancement and deployment of KETs will address societal challenges through the solutions KETs underpin. Therefore a KET support program need to be 'relevant' and 'smart', i.e.: it needs to be result-driven and impact-oriented. Support for this new family of measures must be substantial and at least of the order of magnitude dedicated to curiosity-driven research (cf. Ideas program within FP7). **We estimate the amount necessary to be more than 10 billion Euros over a seven year period.**

The KET program "Enhancing Technological Research" should comprise three major funding operations:

a) **Large scale validation programs (LSVP)** to support "Technology Validation Platforms", TVPs (or "Technology Research Platforms"). These are **technology-driven** by public research and technology stakeholders (such as RTOs) with strong industrial (end-users) orientation. TVPs integrate academic engagement with technology transfer initiatives to create prototyping capacity. TVPs will be regionally based services that can provide the capacity to test and prototype under real production-world conditions/scenarios. They will make available existing production facilities and provide open access to partners from other regions of Europe ("cross-border access to facilities"). They focus on enhancing technology readiness levels to levels 5-6. They can also be seen as **Technology Infrastructures** offering services to external users.
A LSVP should fulfil three criteria:
   - Must have pilot line orientation, technology testing capacity (TRL like), prototyping capability at lab level and common design rules between all partners.
   - Must cover the entire value chain. i.e.: covers a large portfolio of TRL blocks, experienced hand to hand with industry
   - Open to academia to anticipate technology breakthroughs, to capitalize on technology routes available in RTOs, and to leverage team efforts in a pre-competitive phase of technology integration.

b) European Strategic Research Alliances (SRA): SRA are *"long-term technology-driven initiatives*" that have the power and stamina to maintain and follow up 10+ years of technology development with changing industrial partners (SMEs and larger companies) in a KET field. These alliances are led by the RTOs who have the capacity and mission to run long-term precompetitive technological development. SRAs offer the necessary long-term stability to build critical mass and align existing innovation potential in different member states across Europe. An SRA dedicated program will provide leveraging support for strategic cooperation between RTOs and the relevant networks in industry and academia. They will have an amplification effect on RTO-led research & development.

c) Innovation Alliances or streamlined 'Public-Private-Partnerships' (PPPs): are led by industry or RTOs with simple frameworks for the participation of flexible consortia (including industry, academic institutions and RTOs). PPPs are first and foremost directly market-driven and contain the immediately vital elements to scale-up technologies and prototypes into pilot-line production. Preferentially, they support the entire bridge and focus technological research on immediate production. PPPs will provide the demand-driven technology roadmaps for KETs in Europe.

All of these KET-measures are complementary to each other and arranged to enhance speed and technology readiness levels across the innovation chain. The measures are all collaborative in nature and should be operated in the CSFRI in a "Inter-Commission-services" mode. At the same time KET programs will accelerate contributions to solving the societal grand challenges. A dedicated KET program should therefore be complemented by KET-oriented actions throughout the new CSFRI. Special criteria in other programs targeting the grand challenges would increase the effectiveness of a dedicated KET support program.

3.3. A European Technology Research Council (ETRC) should be established dedicated to technology research and innovation projects, similar to the European Research Council for fundamental and frontier research. The ETRC should aim at Technology Excellence and operate KETs research training program to promote Europe's new generations of engineers and technologists. In addition to the paramount criterion of excellence needed in any result-driven funding program, the ETRC will consider relevance and potential impact, i.e., the transformative or disruptive potential of a proposed project as crucial. The goal is **research and innovation programs that promise economic impact for Europe.** Furthermore, the programs should induce an open competition for the best ideas and technical solutions across Europe, create local public awareness for the contributions of KETs to societal challenges, and complement regional support programs with a European-added value. For instance, the ETRC could also operate programs for innovative technologies and entrepreneurship projects similar to the SBIR and STTR Programs in the USA. If this is not feasible then the ERC could be given the explicit dual mandate to support both excellent scientific research AND excellent technological research although this would require a massive change in scope, management schemes and evaluation procedures of the ERC putting its current well-defined profile at risk.

3.4. A clear set of rules/criteria for funding technological research for innovation in the above mentioned KET program - also to be considered as general guidelines for research-for-innovation funding - should be established. The set is geared at relevance, focused on results, professional management and progress monitoring.

These rules/criteria should comprise the following:
- market/industry/demand driven
- precise roadmaps and implementation schemes (beyond pillar 1)
- value-chain and innovation chain consciousness
- more flexible selection of relevant partners (smaller consortia)
- room to combine programmatic road mapping with fast bottom-up schemes (think big, act fast, start small…)
- Eurocentric deployment/IP policies (e.g., by requiring Eurocentric deployment and implementation plans as a default and value creation in Europe as a goal, similar in effect to the US Bayh Doles Act, but taking the needs of European companies in a global market into account, i.e., fostering Eurocentric deployment while avoiding European protectionism)
- encouragement for more SME participation
- progress monitoring ("KET monitoring board"), exit strategies for projects and programs (possibility to stop projects, redirect funds depending on success, etc.)
- potential involvement of executive agencies (similar to ERC) for management of programs (cf. 3.3)
- EU Technology Platforms should be given a higher profile to shape and implement KET programs. However, only if they comply with the criteria of working on the complete knowledge triangle as defined in the report of the ETP Expert group to Potocnik (2009) (see *ETP report 2009*)

Special attention should be given to projects concerning converging technologies (at the interface between KETs, for instance, nanotech & biotech hybrids), which can create value for Europe by jumping ahead of the innovation curve.

3.5 European focused and globally competitive IP policy should be "Bayh-Dole-like". It should pro-actively promote and accelerate innovation and manufacturing in Europe.

Management of results and in particular of IP developed through public funding in KET programs should be based on common exploitation rules, similar to those contained in the Bayh-Dole act in the US, ensuring and benefitting the deployment of KETs in Europe. European technology development programs should require exploitation plans that focus on patenting and exploitation in Europe.. The plan should be obligatory at the beginning of a technology research or large-scale validation project. The exploitation plan should clarify and guarantee a European-added value. IP exploitation (e.g.: licensing) outside of Europe should need special approval through the European Commission if not already approved as part of the exploitation plan when granting the project.

For the realization of any of these recommendations one must keep in mind that a major effort must be to take "smart" and "relevant" decisions. That means taking responsibility for the choices and programs (- why we need a European Innovation Council) and prioritizing themes and proposals according the envisioned. KET support at this stage (enhancing technological research) must also look for leverage at the European scale and maintain excellence as its leitmotif. In that context it will be important to base the program selection on the most urgent technological bottlenecks and the most promising technological pathways and solutions. Technological research-for-innovation must focus on moving across the "innovation bridge" towards relevance and impact: prototyping, pilot lines, first demonstrators, and projects for competitive production - not on curiosity-driven blue sky motifs. The selection decisions should prioritize projects according to the first stage horizontal analyses and the interim horizontal stage reports of the six KETs.

Table 1: Effect of recommendation on identified issues (beginning chapter 2)

	Industrial participation	Risk & trust	IPR management	Technology transfer	Critical mass	Impact-drive
3.1. Innovation Council	advises	advises	advises on	advises	measures	measures
3.2.1. Technology Validation Platform	-	positive	-	positive	-	positive
3.2.2. Strategic Research Alliances	positive	positive	positive	positive	positive	positive
3.2.3. PPPs	positive	positive	positive	positive	positive	positive
3.3. European Technology Research	positive	positive	-	positive	-	positive

Council						
3.4 Set of rules	positive	positiv e	positive	positive	positive	positive
3.5 IP rules	positive	-	positive	positive	-	positive

Top-down programs to align actions to "Grand challenges" are not adequate to organize research and technology development at the project level. However, they will transform the search for solutions to the Grand Challenges into demands on technology similar to a market pull. Fundamental research will not address a market pull by its own, nor can it be expected to provide a solution to a Grand Challenge – it will remain curiosity-driven and open in character of output. Only applied research and technological research can develop the bridge focussed on creating relevant new technologies. It will have both bottom-up and top-down characteristics as resemble by the funding schemes proposed.

The role of RTOs is crucial in this picture. RTOs are by reason of existence technology and innovation-oriented, i.e. impact-driven. They have established relations with industrial partners in their national settings, are engaged in national and regional funded technology projects. Most RTOs are publicly-held, non-profit organizations with tested experience in handling IP rights in a cross-over area from publicly funded research to investment-driven commercial technology markets. RTOs can participate in Strategic Alliances and Research Validation Platforms, i.e. Europe's Technology Infastructure for KETs) and Public-Private-Partnerships. They can provide the ingredients needed for critical mass.

Through their international cooperation they can combine, integrate and disseminate competences also to the less-developed regions in Europe.

4. Case studies

In this section we present an illustrative collection of some of the current ideas and practices without any claims of completeness or conclusiveness. These studies merely cover topics that were discussed within the working group and at the workshop as examples of what is implemented today and how. This is purely given as background information:

Case study: European RTOs

Research and Technology Organisations (RTOs) are mission-oriented knowledge organisations dedicated to the development and transfer of science and technology to the benefit of the economy and society. Well-known RTOs include the TNO in the Netherlands, VTT in Finland, SINTEF in Norway, the CEA in France, and Fraunhofer in Germany (see http://www.earto.eu for more extensive list).

RTOs build bridges between basis research and practical applications by supporting product and process innovation in all branches of industry and services. They help to develop technologies that feed directly into new goods, processes and services. They do technology and market foresight and monitor social developments so that policymakers and businesses can make better decisions about future needs and market opportunities.

RTOs play a major role in the European innovation system. They work with both universities and enterprises, large and small, in order to find practical solutions to the "Grand Challenges" and to advance key enabling technologies, while creating economic growth and employment through more effective exploitation of research and adaptation of technologies for specific business applications. RTOs also play pivotal role in the European Framework Program for Research and Technological Development, coordinating about a third of the projects in which they are involved. RTOs have a strong history of helping SMEs go beyond their capabilities, by providing technological and human resources and expertise not normally available to them and by including them in their networks on the European level. In economic terms, the annual impact of RTOs is estimated at up to €40 billion.

Leading RTOs have recognized the need to build critical mass by cross-border collaboration seriously dedicated to the advancement and deployment of KETs in Europe and to developing solutions to the Grand Challenges. They have launched first initiatives, including the Heterogeneous Technology Alliance where four of Europe's leading research institutes in microelectronics - CEA (France), Fraunhofer (Germany), CSEM (Switzerland), and VTT (Finland) - pool their expertise and share each other's infrastructures for demand-driven research (http://www.hta-online.eu). Other examples are the European Energy Research Alliance (EERA) supporting the Strategic Energy Technology Plan (SET-Plan) with the goal to pool resources and implement joint R&D-programs (http://www.eera-set.eu), or the AERTOS-Project where leading

Case study: The Bayh-Dole Act for IP-exploitation in the US

The Bayh-Dole Act (BDA) was enacted in 1980 by the US Congress as the "University and Small Business Patent Procedure Act". It changed the approach to exploitation of IPR derived from federally funded research by assigning ownership of IPR developed by federally funded research to the institution where it was created. Before the passage of the Act, ownership had been with the US Federal Government which was considered as a major obstacle to exploitation. The BDA put research institutions in a strong position with respect to controlling their own IP portfolio but obliged them also to be diligent in the management and transfer of technologies. In particular, in licensing their IPR, institutions must give preference to SMEs (§ 202). Moreover, exclusive licenses may not be given to companies who do not manufacture the product to a substantial extent in the US, although this may be waived by the Federal agencies in individual cases where it can be shown "that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States or that under the circumstances domestic manufacture is not commercially feasible" (§ 204). Finally, the government retains a so-called "march-in right" to regain title over IPR that has not been exploited within a certain period of time (§ 203).

(U.S. Code:
http://www.law.cornell.edu/uscode/html/uscode35/usc_sup_01_35_10_II_20_18.html)

The impact of the BDA on technology transfer in the U.S. has been widely acknowledged, e.g. in the ProTon report "Experiences on the US knowledge transfer and innovation system" (April 2007). The greatest benefit is described as the change in mentality of senior academic management now recognizing the importance of an institutional IPR-policy. As a second important aspect, the "certainty to title to inventions" is mentioned: private companies working with public research institutions can be sure that those institutions own the IPR and are entitled to license it. As a side-effect, public research institutions are strengthened in their position as - by law and non-negotiable - the IPR remains the property of the research institutions even in cases where private companies co-funded a project. Concerns mentioned in the ProTon report address the "protectionist element" in the BDA concerning exclusivity for U.S.-based manufacturing only - it is noted that the value of this component of BDA "is being eroded by global market changes" - and the "march-in rights" of the government.

The ProTon reports summarizes that: "In sum, all of the various elements, acting in concert, of the Bayh-Dole act appear to still have significant positive effect and their impact has been considerable. The greatest question for Europe is to decide on how

Case study: PPP EFFRA

The Public-Private-Partnership "Factories of the Future" is dedicated to research on manufacturing and production, and transfer into the industrial sector. It was set up for 2010 to 2013 with annual project calls.
EFFRA: European Factories of the Future Research Association is a not-for-profit consortium of the industrial partners in the PPP. Goal is to create a consensus among the private sector of the PPP, to increase transparency and fairness and to assist in the implementation of the PPP
Expectations:

- Industry (private partners) to set the research priorities
- PPP to assist industries to achieve their objectives faster and on a bigger scale
- results must be applied in the real production environment
- Openness to all partners while maintaining necessary confidentiality rules
- Road mapping is a crucial control tool: EFFRA works on strategic multi-annual roadmaps

Annual project calls of the European Commission in cooperation with the Program Committee and AIAG. Calls have grown in volume from ca. 100 M€ in the first year to an expected 230 M€ in the fourth year. Industrial participation is strong (over all over 50%). Success rates ca. 18% due to limitations in the allocated EC budget.
Outlook: PPP need a common specific framework and long-term stability:
New setting must guarantee:

- transparency and openness
- simple procedures for participation, proposal submission, evaluation, reporting and auditing.
- that private partners remain in charge: select staff, manage operations, share

Case study: Grenoble as a Technology Integration Platform

Grenoble: Local cluster of academic institutions, research & technology institutions (LETI, LITEN) , large company (STM, SOITEC) and an environment of SMEs creates a hub of innovation exemplifying technology platform for large -scale validation and "ramp up" of production, touching different KETs (microelectronics, photonics, advanced materials..).
Best practice creates a network of services delivered by the technology integration platform: a research & development infrastructure for research, prototyping and large-scale validation of KETs.

Conditions to realize a technology integration platform:

- Large span of technology blocks qualified by their level of maturity (TRL : Technology Readiness Level)
- Complete value chain awareness & precise yet flexible road map
- Investment in pre-industrial tool
- Design Centre for share design rules with industry
- Prototyping capacity
- Direct channel to Industry to streamline technology development for transfer to industrial pilot line
- Open to academic enabling first stage research and testing (Multi Project Wafer for design academic community)
- IP policy in place to support speedy transition to industry and to develop a leading position

Three cases of strategic alliances of RTOs with Industry have been illustrated:

- cross-disciplinary processing of advanced materials –
    - development of organic electronics and large area electronics :
- integrated photonics –
    - development of SI-photonics :
- microelectronics –
    - 3 dimensional integration.

Demonstrating fast delivery on specifications for larger production in pilot lines, adoption of output (prototypes) to industrial needs, "proof of concept" under real conditions, it is to say large scale validation in RTO facilities directed by industrial pilot lines needs.

Showing the main features of Research Technology Platforms:

- RTO driven, but Industry on board
- Position a step before pilot line
- Prototyping capability
- Design Centre with Industry

Case study: PPP in Industrial Biotech

BE Basic: "bio-based, ecologically balanced sustainable industrial chemistry" is a European public-private partnership led by TU Delft/DSM to develop and test sustainable bio-based solutions for chemical construction, and energy industries, and to control and improve the environment and the quality of life. BE-Basic (2010 – 2015) counts 24**+** partners (international companies, universities and institutes).
Goal is to provide a unique one-stop shop for industrial biotechnology: pot > piloting > port-industry complex
BE Basic is built on proven quality of an existing network/cluster, operated as close as possible to the market needs, uses existing synergies to create an open infrastructure of services that allow to share risks and costs. It covers an R&D program and an innovation program and operates a bio-processing pilot facility. BE Basic also links itself to outside international investors.
Product chains cover biofuels, biomaterials synthesis, nutrients and other products.
Some 300 M€s pledged to joint activities under two different basic ppp schemes:
a.) SME-oriented for fast start-up and prototyping action.
b.) Separate ppp with large company, serves as production anchor to enable volume-up and to lower costs.
Collaboration with other ppps and global partners inn the field of renewables energy and energy efficiency.

Case study: Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs

The United States is running two programs dedicated to funding small business innovation projects (SBIR) and small business technology transfer projects (STTR)

Small Business Innovation Research (SBIR) Program has been running since 1982. The primary goal is to encourage small businesses to stimulate technological innovation and to strengthen role of small business R&D.
Definitions

- Small business < 500 employees
- Micro-enterprise < 25 employees
- Budget: 2.5% set-aside from all US research funding departments with funding budgets larger than 100 mill. $.
- Phase 1: qualifying entrepreneurs can receive up to 150 k$ for a 6 month period to test feasibilty
- Phase 2: max. 1 mill. $ for 2 years available for initial pilot production of the product.

Small Business Technology Transfer (STTR) was set up in 1992 to complement the SBIR program and focus on co-development of small businesses with a US research institution

- Budget: 0.3% earmarked from the budgets of all US research funding departments in the US with budgets larger than 1 bill. $
- Phase 1: max. 150 k$ (< 6 months)
- Phase 2: max. 1 mill. $ (< 2 years)

Both programs have been reviewed and assessed positively by Congress. Currently renewals are pending but expected by 2012.