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COMMUNICATION FROM THE COMMISSION

**TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN
ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE
REGIONS**

‘A European strategy for Key Enabling Technologies – A bridge to growth and jobs’

(Text with EEA relevance)

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1. INTRODUCTION

The EU is determined to keep pace with its main international competitors and to achieve its Europe 2020 objectives. A key element to achieve this is to address major societal challenges with a world-class competitive industry. The capacity of the European Union to develop and industrially deploy Key Enabling Technologies (KETs) plays an important role in contributing to sustainable competitiveness and growth.

The European Commission is convinced that beyond the essential need for fiscal consolidation, further efforts are needed to boost growth, competitiveness and job creation. At the March 2012 European Council, European leaders reinforced this approach, specifically advocating the strengthening of Key Enabling Technologies (KETs)¹.

This Communication outlines a single strategy for KETs to allow maximum exploitation of the EU's potential in competitive markets. Further, it provides feedback to the Parliament and Council following the first KETs Communication² in 2009 and responds to the recommendations of the High-Level Expert Group on Key Enabling Technologies (HLG KETs)³.

2. THE ECONOMIC CONTEXT – THE ROLE OF KETs FOR ENHANCED GROWTH IN THE EU

The Commission defines KETs as *‘knowledge intensive and associated with high R&D intensity, rapid innovation cycles, high capital expenditure and highly skilled employment.*

¹ See European Council Conclusions of 2 March 2012 request stepped up efforts in "strengthening key enabling technologies which are of a systemic importance for the innovativeness of industry and the whole economy".

² Preparing for our future: Developing a common strategy for key enabling technologies in the EU, COM(2009) 512.

³ The Commission established the HLG KETs as an external advisory body in accordance with COM(2009) 512. Its mandate was to (1) assess the competitive situation of the relevant technologies in the EU with particular focus on industrial deployment and their contribution in addressing major societal challenges; (2) analyse in depth the available public and private R&D capacities for KETs in the EU (on all levels); and (3) propose specific policy recommendations for a more effective industrial deployment of KETs in the EU.

They enable process, goods and service innovation throughout the economy and are of systemic relevance. They are multidisciplinary, cutting across many technology areas with a trend towards convergence and integration. KETs can assist technology leaders in other fields to capitalise on their research efforts'.⁴ Based on current research, economic analyses of market trends and their contribution to solving societal challenges, micro-/nanoelectronics, nanotechnology, photonics, advanced materials, industrial biotechnology and advanced manufacturing technologies (recognised as a "cross-cutting" KET) have been identified as the EU's KETs.

KETs are a key source of innovation. They provide indispensable **technology bricks that enable a wide range of product applications**, including those required for developing low carbon energy technologies, improving energy and resource efficiency, boosting the fight against climate change or allowing for healthy ageing.

While it is difficult to determine the exact market potentials of KETs due to their inherent ability to enable advances in all industries and sectors, their direct economic impact is considerable. The Commission's European Competitiveness Report 2010 indicated **a global current market volume of EUR 646 billion (around 2006/2008), which is projected to grow to over EUR 1 trillion by 2015**.⁵

The social return on investments from KETs is substantial. Case studies show that **public investments can generate a return in additional taxes and social security contributions up to more than fourfold the initial investment**.⁶ Even more considerable are the **applications of KETs that directly and indirectly boost competitiveness and generate jobs, growth and wealth in the economy**.⁷

KETs feed into many different industrial value chains and sectors in heterogeneous ways. They create value along the whole chain – from materials through equipment and devices, to products and services. Due to this **transversal nature and systemic relevance** to European industries, KETs will catalyse the strengthening and modernising of the industrial base as well as drive the development of entirely new industries in the coming years.

This transversal and multifaceted role is mirrored by the number of SMEs active in KETs and the number of high quality jobs being created. For example, in nanotechnology alone, employment estimates show that in 2008 there were 160.000 workers globally. This

⁴ Current situation of key enabling technologies in Europe, SEC(2009) 1257.

⁵ Original figures were, respectively, USD 830 – 970 billion and USD 1300 – 4400 billion, SEC(2010) 1276, p. 176.

⁶ For the period of 1994 to 2010, calculations showed that public support to micro- and nano-electronics in terms of subsidies and grants amounted to ca. EUR 1.219 Bio. in Dresden. The return in terms of taxes was calculated at EUR 1.956 Bio. and that of social security at EUR 3.932 Bio. See VDI-TZ/Prognos (2008): Der Halbleiterstandort Dresden; Deutsches Institut für Wirtschaftsforschung (DIW) (2002): Gesamtwirtschaftliche und regionale Bedeutung der Entwicklung des Halbleitstandorts Dresden.

⁷ The main application sectors include automotive, food, chemicals, electronics, textiles, energy, environment, pharmaceuticals, construction, aerospace and telecommunication. SEC(2010) 1276, p. 153. For a detailed analysis see Juluissen, Robinson (2010): The future competitiveness of the European automotive embedded software industry, JRC-IPTS/European Commission, <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=3780>.

represents a 25% increase from 2000.⁸ The **micro- and nanoelectronics** industry and its natural downstream ICT industries created more than 700.000 additional jobs during the last decade in Europe, showing a trend towards more service-oriented and highly skilled jobs and rapid recovery after the crisis.⁹ **Industrial biotechnology** has been recognised as the driving KET for the bioeconomy. It is estimated that every euro invested into research and innovation in this area will result in a tenfold return.¹⁰ Furthermore, SMEs are a key driver of innovation and employment in Europe and are expected to account for the majority of future jobs in KETs. **In the photonics sector the bulk of the 5,000 European companies are SMEs.** In Germany, about 80 % of the **nanotechnology** companies are small or medium sized.¹¹

3. SITUATION ANALYSIS – STRONG ASSETS WITH THE RISK OF LOSING THE COMPETITIVE EDGE

The European Union is a **global leader in KETs development**. It has all the necessary attributes to remain in this position. Based on patent data, the 2010 European Competitiveness Report and the report of the HLG KETs confirmed that the EU holds a strong competitive advantage: it is the only region to master all six KETs. Over the years, Europe's strong R&D base has championed all six KETs, maintaining a leading position with 32 % of the global patent applications between 1991 and 2008.¹² However, despite these strengths, **the EU is not capitalising on its knowledge base**.

As highlighted by the 2009 KETs Communication and confirmed by the HLG KETs, **the EU's major weakness lies in translating its knowledge base into goods and services**. KETs-related manufacturing is decreasing¹³ and EU patents are, more and more, exploited outside the EU. The 2011 Innovation Scoreboard indicates similar trends and the negative impact on SMEs.¹⁴ The HLG KETs termed this gap between basic knowledge generation and its subsequent commercialisation into goods and services as the '**Valley of Death**'. The urgency to act quickly is further demonstrated by recent developments in the **machine tool industry**, one of the key KETs application sectors: the European share in global production dropped from 44% in 2008 to 33% in 2010, to the advantage of Asian competitors, namely China (including Taiwan) and Korea.¹⁵ This lack of **KETs-related manufacturing is all the more detrimental to the EU for two reasons**. Firstly, in the short term, opportunities for growth and job creation will be missed; secondly, in the long term, there may also be a loss of

⁸ See OECD: 'Nanotechnology: An overview based on indicators and statistics' Directorate for Science, Technology and Industry, 2009 (via ObservatoryNano).

⁹ European Commission, The 2010 report on R&D in ICT in the European Union; and European Commission, The 2011 report on R&D in ICT in the European Union, <http://is.jrc.ec.europa.eu/pages/ISG/PREDICT.html>.

¹⁰ Innovating for Sustainable Growth: A Bioeconomy for Europe, COM(2012) 60

¹¹ See OECD (2009) (via ObservatoryNano).

¹² SEC(2010) 1276.

¹³ See also Académie Royale de Belgique (2010): The de-industrialisation of Europe; EIB Papers 11. No 1/2006, An industrial policy for Europe? Context and concepts.

¹⁴ While European performance in R&D increased between 2010 and 2011, as demonstrated for example by the 6% increase in international scientific co-publications, commercialisation activities decreased, as shown by the 0.7% decline in European SMEs introducing product or process innovations and a drop in sales of new-to-market and new-to-firm innovations of 1.2%. See Innovation Scoreboard 2011, 7 February 2012, <http://www.proinno-europe.eu/inno-metrics/page/innovation-union-scoreboard-2011>. The same trends were presented in the 2010 Innovation Scoreboard.

¹⁵ See CECIMO: 'Study on the Competitiveness of the European Machine Tool Industry', <http://www.cecimo.eu/comunications/news/161-cecimocompstudy.html>.

knowledge generation, because R&D and manufacturing are intrinsically linked, mutually reinforcing and, thus, often take place in close proximity to each other.

The reasons why the EU has **not taken sufficient and timely commercial advantage of its excellent research base in KETs** are the following:

Until recently, the EU had **no common definition and understanding of KETs**. The 2009 KETs Communication defined the EU's key enabling technologies for the first time and advocated for a common understanding also at Member States level. It also identified the key policies, which would need to be addressed, in order to accelerate the industrial deployment of KETs. Insufficient policies were in place that aimed at **(1) tapping into the synergistic impact of KETs** and **(2) accelerating their "time to market"**.

Most innovative products nowadays, whether it is the smart phone or electric car, incorporate several KETs simultaneously, as single or integrated parts. Thus, combining KETs to ensure maximisation of synergistic impact is important. Although collaborative efforts, in particular with industry in the scope of public-private partnerships (PPPs) and the SET-Plan¹⁶, already take place today, the **interdisciplinary character** of individual KETs throughout the value-chain has to be further strengthened and an integrated approach to supporting KETs is therefore required.

The timely commercialisation of KETs requires the development of high-risk **product demonstration and proof-of-concept projects**. The Commission's flagship initiative "Innovation Union"¹⁷ confirmed this approach and the proposals under Horizon 2020¹⁸ envisage increased product demonstration activities under this framework. The size, scope and costs of these industrial research and experimental development activities, often an order of magnitude higher than fundamental research activities, require a **more effective use and coordination of public resources**. In addition, these innovation projects are closer to the market and, where constitutive of State aid, public support is subject to **State aid rules**.

KETs-based products are very **capital intensive**. Their research and innovation development periods are lengthy and production processes include complex assembly methods. For private investors, therefore, KETs are associated with extremely high risks. This coupled with the **insufficient access to appropriate sources of risk capital** in the EU, of which start-ups and SMEs are particularly dependent, leads to the fact that many innovations never enter the market. With the economic crisis, the situation has become even more critical. As an example, in 2000 EUR 22 billion of venture capital was raised in Europe. In 2010, the amount raised fell to only EUR 3 billion. Again, considering current public finance constraints, it is essential to **pool and coordinate public resources across different EU instruments** and to allow for their most effective and target-oriented use.

The **fragmentation of the EU internal market, coordination failures and other obstacles** to effective competition in the KETs markets (e.g. entry barriers) diminish the growth potential of KETs. It is the largest integrated market in the world that is receptive to innovations, with world leading industries in fields of automotive, chemicals, aeronautics, space, health and energy – many of whom use KETs in their products. Therefore, cooperation between actors along the industrial value chain in the EU offers huge potential in terms of

¹⁶ Investing in the Development of Low Carbon Technologies (SET-Plan), COM(2009) 519

¹⁷ COM(2010) 546.

¹⁸ COM(2011) 808, 809, 810 and 811 of 30 November 2011.

partnering and access to markets. However, due to **information asymmetries** in particular for start-ups and SMEs, which face entry barriers and high transaction costs in finding the right partners, many of these potentials remain untapped.¹⁹ A more efficient and transparent flow of information and data on KETs development and deployment activities in the EU is therefore needed. **Overcoming regulatory differences across Member States, discriminatory enforcement and other forms of arbitrage can further help to reach the potential offered by the internal market. As such, cooperation between different regions and Member States will need to be reinforced.**

The **shortage of sufficient skilled labour and entrepreneurs** capable of handling the highly multi-disciplinary nature of KETs remains a major problem in the EU. In the area of e-skills, for example, the level of computer science graduates is declining while up to 700.000 ICT practitioners will be needed to fill vacancies in the EU by the year 2015. More specifically, in the KETs-area of nanotechnology, estimates indicate that 400.000 jobs will be needed in Europe by 2015.²⁰ For photonics, estimates suggest that 80.000 additional qualified experts²¹ will be needed in order to cope with the anticipated rapid industry growth and the retirement of skilled workers.

A coherent European strategy is hence necessary to overcome the issues identified in order to fully tap into the relative strengths of the European Union in favour of growth and jobs.

4. THE WAY AHEAD – A EUROPEAN STRATEGY FOR KETs

KETs-related actions are currently fragmented amongst the various actors (EU, national and regional authorities). The overarching aim of this Communication is to **create synergies between EU policies and instruments and ensure coordination of EU and national activities.**

Besides representing a policy umbrella for initiatives that address specific technologies in more detail²², this horizontal strategy relevant for all KETs aims above all at aligning efforts so as to make best use of public resources in a targeted and results-oriented manner. **While not proposing an increase of public financing for KETs, this new framework will allow for more efficient and productive allocation of these resources.**

The Commission has already identified KETs as a priority within its Europe 2020 strategy and its flagship initiatives²³ and now proposes a **European strategy for KETs** built upon three pillars: technological research, product demonstration and competitive manufacturing activities.

The KETs strategy will help reversing the trend of de-manufacturing and accelerate the rate of transfer, use and exploitation of KETs in the EU, in order to stimulate growth and jobs.

¹⁹ See InnovaEurope with Technopolis: 'Feasibility study on new forms of EU support to Member States and Regions to foster SMEs innovation capacity', Chapter 8.

²⁰ See OECD: 'Nanotechnology: An overview based on indicators and statistics' Directorate for Science, Technology and Industry, 2009 (via ObservatoryNano).

²¹ See Working Group Report on Photonics, HLG KETs.

²² See for example "A Bioeconomy for Europe, COM(2012)60", "Lighting the Future" COM(2011) 889.

²³ See Innovation Union (COM(2010) 546), An Industrial Policy for the globalisation era (COM(2010) 614), A Digital Agenda for Europe (COM(2010) 245).

The EU cannot, however, tackle these challenges alone. KETs deployment activities require a holistic approach. EU activities have no leverage if they are not closely aligned with and complemented by national and regional activities. The Commission's 2012 Annual Growth Survey²⁴ stressed that national efforts need to be stepped up to promote sustainable growth and competitiveness by structural reform. As KETs are a driving force behind the development of new goods and services, EU Member States have a strong interest in prioritising them. National efforts should be intensified to adapt industrial innovation policies and put appropriate mechanisms in place.

Finally, **EU stakeholders, in particular industry, will have to play their role.** The Commission has shown its willingness to promote more risky and costly innovation projects which are closer to the market and of key relevance to the competitiveness of the EU. In times of limited public finances, it is all the more important that public funds should generate a return on investment in favour of growth and jobs. The members of the High-Level Expert Group have, in this context, agreed on stakeholder commitments for the establishment of industrial pilot lines. Building upon these commitments, industrial stakeholders are expected to develop and sign a memorandum of understanding (MoU) among them, which should express their commitment to contribute through KETs to the Europe 2020 strategy on smart, sustainable and inclusive growth.

Particular attention has to be paid to allowing EU, national and regional policymakers to have the right instruments and regulatory framework in place so that all the crucial stages of KETs research, development and innovation (R&D&I) activities can be developed, in a way that ensures the efficient functioning of competitive markets.

The strategy in this Communication aims to:

- focus EU policies in the next multi-annual financial framework on research and innovation, cohesion policy, and prioritise EIB lending activities in favour of KETs deployment;
- ensure coordination of EU and national activities so as to achieve synergies and complementarities between those activities and the pooling of resources where necessary;
- establish an external KETs Issues Group that will advise the Commission on KETs-related policy issues;
- mobilise existing trade instruments to ensure fair competition and a level international playing field.

5. AN INTEGRATED FRAMEWORK FOR KETs

The Commission has taken up the need to address KETs in a coherent manner in its proposals for the new generation of EU financial programmes.

²⁴ Annual Growth Survey 2012, COM(2011) 815.

In the next multi-annual financial framework (MFF) **the Commission has proposed a more balanced and efficient allocation of EU resources for all the stages of KETs R&D&I activities.** Activities under Horizon 2020, the EU's cohesion policy (structural funds) and policies of the European Investment Bank Group are therefore being adapted and closely coordinated so that they contribute the European KETs strategy.

A key element of this coordination lies in leveraging the funding instruments at the EU's disposal. To this end, **the possible combined financing of KETs projects through Horizon 2020, structural funds and EIB loans will be enabled by the proposed common provisions regulation²⁵ of the new cohesion policy.** The chart in the Annex clarifies the role of each of these instruments, which will also complement each other, in supporting KETs initiatives.

The use of public procurement of innovation, particularly when it comes to pre-commercial procurement, should also be encouraged. Public procurement represents 19% of EU GDP and in certain niche sectors, where KETs are involved, public procurement can play a vital role for businesses.

Where public funding is used for KETs, it must be targeted at proven market failures that prevent the development and deployment of KETs. As undistorted competition is the most effective driver to invest in KETs, such funding must be in accordance with State aid rules to prevent distortions of competition, such as crowding-out of private funding, creating ineffective market structures or preserving inefficient firms. The current macroeconomic environment calls for particular care in deciding and designing public spending in an effective and efficient way to ensure the greatest benefits for growth and jobs.

The Commission aims to further enhance coherence and produce synergies, as outlined in the chapters below.

5.1. KETs research and innovation financing – an integrated approach

*Horizon 2020*²⁶ is the new framework programme which, for the first time, combines research and innovation covering the entire value chain. It supports the integration of research and innovation activities, thus allowing the translation of knowledge into marketable goods and services.

Horizon 2020 pays particular attention to the development and application of KETs, highlighting their importance for growth and jobs. With a proposed combined earmarked budget of EUR 6.663 billion, KETs represent a major component of the 'Leadership in Enabling and Industrial Technologies' (LEIT) strand of the Commission proposal. For this priority strand, a systemic approach has been proposed with strategic and operational targets for each of the six KETs. It includes support for both technology-specific and multi-disciplinary research, and most importantly, a strongly integrated approach.

This integrated approach is crucial to effectively translating research and technology development into marketable products and economic growth. An effective way of implementing this approach is through innovation-oriented European Technology Platforms (ETPs) and public-private partnerships (PPPs). These include the ENIAC Joint Technology

²⁵ See Art. 55 (8) Proposal for a Regulation on Common Provisions, COM(2011) 615.

²⁶ COM(2011) 808, 809, 810 and 811 of 30 November 2011.

Initiative (JTI) in nano-electronics, Factories of the Future and the Energy-efficient buildings PPPs. New PPPs may also be launched under Horizon 2020 addressing photonics and the process industries. These PPPs must fulfil the selection criteria set out in Horizon 2020²⁷, and should be based on the criterion of excellence, focus on genuinely cross-border elements to reinforce the EU's knowledge base, leverage additional investments in research and innovation, have long-term industrial commitments on a shared vision and clearly work towards the common objectives of as well as monitor progress towards the agreed objectives.

While individual KETs are recognised as indispensable sources of innovation, **the cross-fertilisation of different KETs is vital**, in particular for the transition from R&D to pilot and industrial scale production. A considerable part of the KETs activities planned under Horizon 2020 will be dedicated to **cross-cutting activities**, which will bring together different KETs for developing innovative products and for contributing to solving *societal challenges*.

In this way:

- dedicated support for larger-scale pilot lines and demonstrator projects exploiting the interdisciplinary nature of KETs will achieve validation under industrial conditions and qualified manufacturing systems that shorten time-to-market entry;
- linkages between KETs, product development and application will allow the required cross-disciplinary research and innovation to provide innovative solutions to societal challenges²⁸, including those internationally recognised development challenges, and to reduce lead time to market; and
- within the Commission and in the context of Horizon 2020 governance structures, an interservice group will ensure the preparation of a joint work programme for cross-cutting KETs and coherence between all KETs-related programmes within Horizon 2020. This includes synergies with societal challenges and activities under the cohesion policy framework, as well as the European Institute of Innovation and Technology (EIT).

KETs innovation projects under LEIT, that are close to the market, are of key significance for the competitiveness of the European Union. While excellence is the main selection and performance criterion, this might require additional obligations at the level of the grant agreement, such as the development of a detailed business plan and a request to create consortia along the relevant parts of the industrial value chain. **Project participants might also be requested to demonstrate, in their exploitation plan, how project results would contribute to market value in the EU.** Such requirements would aim at increasing the leverage effect of a research and innovation project, i.e. **ensuring a social return on investment and the creation of jobs in the EU, in line with the Europe 2020 strategy for smart, sustainable and inclusive growth.**

The Commission :

- has proposed to allocate EUR 6.663 billion in industrial capabilities on KETs in Horizon 2020. This includes support for pilot lines and demonstrator projects, including those of larger scale, for achieving technology and product validation under industrial conditions

²⁷ Article 19, COM(2011) 809 final

²⁸ Such as health and well-being, clean and efficient energy, smart, green and integrated transport, resource efficiency or climate change

and more integration and cross-fertilisation between the six KETs. There will be a particular focus on projects that provide integration between the different KETs or integration between the KETs and their applications to address societal challenges;

- will work in the course of 2012 on a synthesis of the respective KETs-related activities in different groupings (ETPs, PPPs, JTIs) in order to assess current cross-cutting KETs activities and to identify future market technology needs. This is with a view to preparing a multi-annual work programme, for cross-cutting KETs activities, and coordinating closely with other relevant programmes (EIT KICs, structural funds, etc.); and
- has proposed to implement innovation-oriented public-private partnerships (PPPs) for those KETs where the necessary conditions specified in Horizon 2020 are in place. Such PPPs will ensure close interaction between research and innovation activities and support the cooperation of all stakeholders, including end-users, across the entire value chain. They will be based on a long-term commitment from all partners sharing a common vision and clearly defined objectives.

5.2. KETs in Cohesion Policy

KETs have the potential to bring growth to regions and enhance their overall competitiveness. They have the potential to connect industrial value chains across regions in Europe, from technology developers via suppliers to producers, and hence allow any European region to find its specific niche. In particular for less developed regions, it is of key importance to have access to these technologies in order to modernise the industrial base and improve competitiveness.

The Commission has therefore identified **KETs as one of the investment priorities for regional innovation financing in its proposal for revision of the European Regional Development Fund (ERDF)**. By introducing the new concept of ‘**smart specialisation**’ as an ‘ex-ante conditionality’, a more strategic approach to regional innovation financing has been proposed. Smart specialisation seeks the involvement of all regions in using their diversity to their advantage to achieve smart growth.

For the proposed new financial programming period, Member States and regions will be asked to develop national and/or regional research and innovation strategies for smart specialisation identifying their unique assets and competitive advantages. Regions are encouraged to identify their particular niche in European value chains with regard to KETs development and/or deployment. **The new ERDF proposal opens up wider opportunities for regions to support all the crucial stages of technology and product development. The scope for eligible funding includes ‘technological and applied research, pilot lines, early product validation actions, advanced manufacturing capabilities and first production’.**²⁹ Adequate attention should be paid to the abovementioned cross-fertilisation of different KETs.

The **Commission’s cluster policy**³⁰ presents an additional tool to enhance cooperation between different actors within and across European regions. It provides a fertile business environment for companies, especially start-ups and SMEs, to collaborate with research

²⁹ See Article 5 (1) (c) ERDF Proposal, COM(2011) 614.

³⁰ Towards world-class clusters in the European Union, COM(2008) 652.

institutions, suppliers, customers, industry users and competitors located in the same geographical area. With global competition increasing, critical mass is more and more important. Enhanced trans-regional cooperation is necessary to allow regions to tap into their respective complementarities. More training and matchmaking activities for cluster managers could further help this process. The European Territorial Cooperation (specifically INTERREG³¹), aims at providing regions with the means to cooperate in this regard.

The Commission:

- will promote KETs-related cluster-specific actions in KETs-related domains, such as *train the trainer* seminars addressed to cluster managers, *cluster visits* to trigger cooperation and sharing of competences, and *international matchmaking events* to promote the commercialisation of KETs-based products abroad;
- will launch a study on national KETs policies to promote the exchange of good practices in this area; and
- will ensure that cooperation in the area of KETs is enhanced with the Committee of the Regions in line with the *Protocol on the Cooperation between the European Commission and the Committee of the Regions*.

Member States and regions are invited to:

- exploit research and innovation strategies for smart specialisation to support spill-over effects of KETs-based solutions, strengthening existing and possibly developing new European industrial value chains;
- encourage managing authorities responsible for the development of smart specialisation strategies to closely interact with their fellow authorities responsible for research and innovation policies, in particular as far as Horizon 2020 programmes are concerned. This would allow for maximum synergies in KETs. The Commission will aim at assisting this process through the Smart Specialisation Platform³²; and
- make also use of INTERREG and other Structural Fund programmes to exploit complementarities between regional smart specialisation strategies and support spill-over effects of KETs-based solutions, strengthening existing and possibly developing new European industrial value chains through transnational and multi-disciplinary cooperation.

5.3. State aid

The least distortive way to support KETs is by measures not constituting State aid in the sense of Art. 107(1) TFEU (e.g. by general fiscal measures, promotion of knowledge partnerships, general training measures etc.). To the extent that State aid is necessary, it must be compatible with internal market. State aid rules provide Member States with compatibility criteria and define a range of possibilities that Member States have at their disposal. Hence, they may support undertakings that are active in the area of KETs by granting State aid for research,

³¹ http://ec.europa.eu/regional_policy/how/index_en.cfm#3

³² SWD(2012) 61.

development and innovation (R&D&I), as well as other types of aid, such as aid for risk capital investments.

The *R&D&I State aid framework*³³ provides a basis to assess State aid for KETs-related R&D&I activities in the EU. On condition that State aid addresses a clearly identified market failure, is limited to the minimum necessary and has a genuine incentive effect, the R&D&I framework allows aid for a range of activities. These include technical feasibility studies, industrial research and experimental development, as well as industrial property-rights costs for SMEs, and assistance to young innovative enterprises and to innovation clusters. In all cases, the R&D&I framework establishes clear compatibility criteria based on Art. 107(3)(c) TFEU and thus provides legal certainty, including for very large projects or sets of projects jointly notified to the Commission.³⁴ Furthermore, Member States may grant R&D&I aid without priori notification to the Commission, provided such aid stays within the limits set out in the *General Block Exemption Regulation (GBER)*³⁵. This has simplified the granting of aid significantly.³⁶ The R&D&I-framework is for the most part based on Art. 107(3)(c) of the TFEU which has been also the legal basis used in all State aid cases with KET-objective under the current R&D&I Framework. The R&D&I Framework also provides for specific criteria to assess R&D&I aid for an important project of common European interest in the meaning of Art. 107(3)(b) TFEU. This legal basis was used for projects very rarely and only before the applicability of the current R&D&I Framework (e.g. the French ‘Medea+’ programme: Decision of 12.3.2002, N 702/A/2001, which entailed support to micro and nanoelectronic projects; and support for high definition television). Subject to a case-by-case assessment, such aid may be authorised up to the level that proves necessary to overcome the pronounced market failures and risks that hinder the deployment of large-scale, cross-border projects. The R&D&I state aid framework is applicable until 31.12.2013 and will be reviewed in line with the objectives of the recently launched State aid modernisation.

The Commission:

- recalls its intention to modernise State aid rules, as announced in its Communication on State Aid Modernisation³⁷, including the R&D&I-Framework, to support the implementation of the Europe 2020 strategy for growth and to enhance the quality of public spending. In particular, modernised rules should facilitate the treatment of State aid which is well-designed, targeted at proven market failures and has a clear incentive effect and limited impact on competition.

5.4. The European Investment Bank

The European Investment Bank (EIB) Group, the EU’s financing institution, supports the EU’s policy objectives by financing viable capital projects. The EIB has played a key role in building up the EU’s knowledge-based economy. It has actively supported European R&D

³³ Community Framework for State aid for Research and Development and Innovation, OJ C 323, 30.12.2006, p. 1.

³⁴ Since 2007, the Commission has authorised more than 200 aid schemes under the R&D&I framework for Member States to support KETs. In addition, more than 30 individual measures dedicated to larger-scale KETs innovation projects have been authorised with an overall amount of more than EUR 1.7 billion in aid.

³⁵ Commission Regulation (EC) No 800/2008 of 6 August 2008, OJ L 214, 9.8.2008, p. 3.

³⁶ Since its adoption in 2008, Member States have put into force over 300 R&D&I aid schemes.

³⁷ COM(2012) 209 final of 8.5.2012.

projects by lending almost EUR 103 billion in the period 2000-2011, of which EUR 10 billion was invested in loans, guarantees, and risk and venture capital in 2011 alone. **In the area of KETs, the EIB provides ca. EUR 1 billion per year.** Moreover, because of the EIB's reputation for its prudent lending policy and its strong market and technological know-how, the Bank serves as an important catalyst for attracting additional funding from public and private investors.

The EIB will remain a key player in financing all the crucial stages of KETs development and deployment. For R&D&I support, the Risk Sharing Finance Facility (RSFF), a joint financial product with the Commission, available to public institutions and private companies of all sizes, offers an attractive funding source to support higher-risk R&D&I projects in the area of KETs. So far, it has funded 75 companies R&D&I projects with over €7 billion. The Commission intends to build on the success of the programme by expanding the RSFF under *Horizon 2020*.

On 5 December 2011, the Commission and EIB/EIF launched the **SME risk-sharing instrument (RSI)**, which will help innovative and fast-growing SMEs fund their R&D&I projects. This pilot programme will be managed by the EIF and implemented via a risk sharing guarantee scheme with banks. Additional measures have been taken to facilitate the funding of research infrastructure projects using RSFF resources. These new schemes should also facilitate access to funding for a wider group of KETs sector participants. Separately, for projects which are closer to the market, such as pilot lines, demonstration plants and investments in innovative assets related to production facilities, the EIB will continue its important lending activities in terms of loans and guarantees. Finally, **the EIB and the Commission will identify priority investment activities for KETs in a common agreement.**

The Commission will:

- work out an agreement with the EIB, which will define KETs as a mutual priority area and provide details on the eligible support for KETs-related projects, including all stages of R&D&I up to first production;
- ensure together with the EIB that vital lending is provided to eligible private-sector investments in product demonstration and first production projects promoting KETs across all European regions; and
- continue with the EIB its vital R&D&I support to KETs projects, notably within the RSFF, and provide additional resources via the new *SME risk-sharing instrument* (RSI, managed by the EIF) for the next financing period.

5.5. Enhancing international cooperation in favour of KETs

The Commission is working towards a more favourable trade environment at the bilateral and multilateral level. Several of these activities are of key importance to actors in the field of KETs. This includes efforts to improve the protection of intellectual property rights (IPR) and provisions to eliminate tariff and non-tariff barriers.³⁸ Further, the Commission aims to ensure fair competition and to address undue subsidisation. In the plurilateral setting of the

³⁸ See for example the Free Trade Agreement with South Korea, <http://ec.europa.eu/trade/creating-opportunities/bilateral-relations/countries/korea/>

Government/Authorities Meeting on Semiconductors (GAMS), the Commission has conducted activities with regard to anti-counterfeiting, transparency on government support measures and tariff liberalisation of new semiconductor products.

In line with its proposal on Horizon 2020, the Commission will further promote cooperation with third countries in the area of KETs, based on common interest and mutual benefit. This international cooperation in scientific, technological and innovation activities shall contribute to achieving the Europe 2020 strategy and the Union's commitments to the Millennium Development Goals.³⁹

The Commission will:

- strive to ensure a favourable trade environment and a global level playing field. This includes the facilitation of market access and investment opportunities, avoiding international market distortion, improving IPR protection, promoting reciprocity notably in public procurement, reducing the use of subsidies and tariff and non-tariff barriers at global level and verifying compliance with applicable EU and WTO rules.

5.6. Skills

The rapidly growing markets in KETs-related sectors require an increasing number of professionals at all technical levels and in different disciplines. Already today, there is a significant gap between the demand and supply in Science, Technology, Engineering and Maths (STEM) education and careers.⁴⁰

The upcoming EU Skills Panorama initiative, which the Commission will launch by end of 2012, will present a forecasting tool to monitor present and future skill needs by labour markets. This online tool will present short-term and medium-term prospects for skills and jobs at national, sectoral and occupational level.

Technological change has far-reaching implications for formal education systems and access to lifelong learning opportunities for adults. The Commission's 'Agenda for New Skills and Jobs'⁴¹ responds to these needs by stressing the importance of adapting curricula, training programmes or qualifications needs and modernising education and training systems to the challenges of a knowledge economy, with a particular focus on entrepreneurship, ICT skills, multi-disciplinarity and creativity. These skills, alongside specialist knowledge, are crucial for making the most of technological advances offered by the development and deployment of KETs. Schools, vocational colleges and higher education institutions need to provide a technology-friendly education and develop a creative problem-solving mindset. Industry-based training or work-based learning, open and flexible learning through ICT, and on-the-job skills development are also important parts of lifelong learning strategies.

Strengthening and inter-linking activities around the knowledge triangle between research, education and innovation is of key importance in this context. While it is crucial to develop a large talent pool, it is even more essential to have the right skills in the right place and at the

³⁹ Recital 30, COM((2011) 809/3.

⁴⁰ See OECD/PISA (2009). According to the German Association of Engineers (VDI), in Germany alone almost 80.000 engineer posts were not filled in 2011, http://www.vdi.de/uploads/media/Ingenieurmonitor_2012-02.pdf.

⁴¹ COM(2010) 682.

right time. **The Commission will thus support training activities aimed at improving skills (not only technical but also entrepreneurial and business-related) in KETs product demonstration projects under Horizon 2020.** The EIT and its Knowledge and Innovation Communities (KICs) have a very important role to play, not least in re-shaping the education landscape in the relevant priority fields of operation. Cooperation between local respectively regional schools and firms in developing training programmes could be one promising solution to help developing relevant skills.

By creating closer links between labour market needs and education or training provision, KICs promote joint post-graduate professional training and industrial ‘real-life’ courses. For the next financial perspective, **the Commission proposed added-value manufacturing⁴² as one of the new KICs after 2013.** This KIC would provide a forum for interaction and promotion of trans-disciplinary skills and competences, addressing the need for a highly qualified work force in the fields relating to KETs.

Further Commission actions include **the Marie Curie Actions (MCA) which improve the training and career prospects of researchers, including in areas that directly support the KETs.** Also the Knowledge Alliances, which started as a pilot project of the Commission in 2011, will contribute to enhancing KETs-related skills. As a future part of the ‘Erasmus for All’ programme, they will bring together businesses and higher education institutions in structured partnerships to strengthen and develop Europe’s innovation potential. In addition, the Commission will test in 2012 Sector Skills Alliances, which are strategic partnerships for Vocational, Education and Training (VET) with the aim to supply skills and improve competitiveness of traditional or emerging sectors. Finally, in line with initiatives such as the EU Blue Card Directive⁴³ or the Commission proposal on intra-corporate transferees in the EU⁴⁴, high-skilled labour from outside of the EU could be attracted to address these skills shortages.

The Commission will:

- under Horizon 2020 continue and reinforce actions to attract youngsters to KETs and include training activities aimed at improving skills in KETs product demonstration projects;
- encourage the establishment by the EIT of a KIC on *added-value manufacturing* that would integrate business, research and higher education in this field and, inter alia, allow for targeted skills development and related education and innovation activities;
- publish a Communication which will address the changing and rapidly evolving challenges for skills supply in the EU by the end of 2012;
- develop partnerships between education and business such as Knowledge Alliances for

⁴² Added value manufacturing defines an integrated system that delivers value by delivering product/service innovation, establishing process excellence, achieving high brand recognition and/or contributing to a sustainable society. See Proposal for a Decision of the European Parliament and of the Council on the Strategic Innovation Agenda of the European Institute of Innovation and Technology (EIT): the contribution of the EIT to a more innovative Europe, COM(2011) 822.

⁴³ Council Directive 2009/50/EC of 25 May 2009 on the conditions of entry and residence of third-country nationals for the purposes of highly qualified employment.

⁴⁴ Proposal for a Directive of the European Parliament and of the Council on conditions of entry and residence of third-country nationals in the framework of an intra-corporate transfer, COM(2010) 378.

Higher Education (HE) in order to foster innovation and allow for more targeted curricula with regard to market needs including KETs; and

- look at ways to increase the supply of skilled labour in KETs-related areas, including through highly skilled talent from outside the EU.

5.7. Collecting market data on KETs – establishing the KETs monitoring mechanism

Up until now, there has been no validated market data on development and take-up of KETs in the EU. The Commission will therefore set up a monitoring mechanism (observatory) to follow up, measure and appraise the deployment of KETs in the EU. For this purpose, a feasibility study has been launched with the aim of establishing the observatory in 2013. The objective of this observatory is to provide EU, national and regional policymakers with information to better develop and implement industrial policies regarding the deployment of KETs. Further, it will provide stakeholders with relevant information on the trends and developments of KETs related industrial sectors in the EU with reference to other competing economies.

The Commission will:

- launch a monitoring mechanism on KETs in 2013, which will provide relevant market data on the supply of and demand for KETs in the EU and other regions; and
- make the results of the monitoring mechanism publicly available on a dedicated website.

6. CONCLUSIONS/NEXT STEPS

The capacity of the European Union to develop and industrially deploy KETs will to a large extent determine how well it fares in the future. The European Union faces three major challenges: (a) to maintain global technological leadership; (b) to master societal challenges based on KETs applications; and (c) to modernise and reinforce its industrial base.

The KETs defined in 2009 have become a priority on the EU's agenda. This is further reflected by their key role in Commission proposals on Horizon 2020 and the European Regional Development Fund. With this Communication, the Commission proposes an all-encompassing and long-term strategy, which includes all relevant Community instruments and key stakeholders.

The systemic relevance of KETs to the EU's capability to innovate and modernise its industrial base requires the Commission's constant attention. The Commission will therefore provide for regular follow-up, evaluation and adaptation of its policies. This will entail regular discussions with Member States and stakeholders.

ANNEX

1. DEFINITION OF A KETS-BASED PRODUCT

A KETs-based product is:

- (a) an enabling product for the development of goods and services enhancing their overall commercial and social value;
- (b) induced by constituent parts that are based on nanotechnology, micro-/nanoelectronics, industrial biotechnology, advanced materials and/or photonics; and, but not limited to
- (c) produced by advanced manufacturing technologies.

2. KETS FUNDING OPPORTUNITIES ELIGIBLE UNDER EU INSTRUMENTS

The financing instruments that are applicable to KETs-related research and innovation activities use slightly different terminologies. The chart below helps to clarify the stages of the technology development phase that the respective terminology corresponds to. The HLG KETs worked with the 'Technology Readiness Levels' (TRL) scale, which is applied by many public and industry stakeholders to assess the maturity of evolving technologies (materials, components, devices, etc.). It is important to note that whereas the TRL scale and EU instruments describe processes, the EIB measurement describes the stage of a product's development.

This chart is indicative.

2.1. Definitions and criteria applied for R&D&I funding under EU policies and laws

