

# High-Level Expert Group on Key Enabling Technologies

# Status implementation Report



EUROPEAN  
COMMISSION





HIGH-LEVEL EXPERT GROUP ON

# Key Enabling Technologies

**Status implementation  
Report**

July 2013

# Preface

Key Enabling Technologies (KETs) or combinations of KETs (Multi-KETs) are at the heart of most advanced products today. Without KETs, there would be no computers, no mobile phones, no cameras, no electric cars, no lighting. In short, KETs are at the heart of innovation. They provide indispensable technology building bricks that enable a wide range of products, as well as driving the development of entirely new industries.

In 2009, the European Commission identified KETs for their potential impact in strengthening Europe's industrial and innovation capacity. The first High Level Group on KETs was launched on the 13th of July 2010 tasked with the elaboration of a coherent European strategy to develop six KETs in Europe and, bring them most effectively to the market. This first HLG KET identified a weak link in the European innovation chain, namely that of translating its science and knowledge into products on global markets. It called this gap the KETs "valley of death". In its report on the 28th of June, 2011, the HLG KET proposed a three pillar bridge concept to pass across the valley of death, focusing on developing technological research, stimulating industrial pilot lines across Europe, and putting in place a globally competitive manufacturing landscape. Its recommendations were addressed in the publication of the European Commission communication "The European strategy for KETs – A bridge to growth and jobs" adopted by the EC in June 2012. This communication also recommended the establishment of a second High Level Group on KETs with a mandate to provide advice on, and accelerate the implementation of this European KETs Strategy.

This second High Level Group on KETs was launched on the 27th of February 2013 in the presence of Vice-president and Commissioner for Industry and Enterprise, Mr. Tajani, Vice-president and Commissioner for the Digital Agenda, Mrs. Kroes, Commissioner for Research and Innovation, Mrs. Geoghegan-Quinn, and Commissioner for Regional Policy, Mr. Hahn, along with the thirty-four HLG Members, consisting of representatives from key actors along strategic European value chains, including technology representatives from each of the six KETs, down-stream industry, cross-cutting KETs representatives, civil society representatives, the European Investment Bank, as well as representatives of relevant Public-Private-Partnerships (PPPs).

Its formal remit is :

- To discuss and advise the Commission on any KETs-related policy issues;
- To follow up the implementation of the European Strategy for Key Enabling Technologies adopted by the Commission on 26 June 2012;
- To promote the development of KETs policies by the Member States.

At its kick-off meeting, Vice-president Tajani, recognizing the urgency to act decisively on implementing the KETs strategy, and in the context of the ongoing negotiations on the future European programs, policies and instruments, requested the second HLG KET to respond with an initial analysis of the bottlenecks and potential solution path to the rapid implementation of the KETs strategy for a competitive Europe.

This Status Implementation Report therefore focuses on the implementation of the KETs recommendations within Horizon 2020, related programs and policy areas. It is built around two key thrusts: Reindustrializing Europe by KETs innovation and initiating KETs enablers to support European competitiveness and jobs. Its ten implementation recommendations are designed to accelerate both the development and deployment of KETs in Europe.

This HLG KET reiterates that those nations and regions mastering KETs will be at the forefront of future advanced and sustainable economies, integrating cutting edge technologies into their products and manufacturing industries. This is the only way forward to ensure the welfare, prosperity and security of our European citizens. The HLG therefore respectfully requests the European Commission, Member States and regions, those best positioned to give effect to our HLG-KET implementation recommendations, to act decisively, to act rapidly, and to act courageously to ensure that the energy, effort and political support which has been spent on this KET process, since 2009, is translated into competitive advantage for Europe.

**Jean Therme**

President of the High Level Group on Key Enabling Technologies



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# EXECUTIVE SUMMARY

## Strategic importance of Key Enabling Technologies for Europe

The European Commission communication "The European strategy for KETs – A bridge to growth and jobs" adopted by the EC in June 2012, reiterated the strategic importance of KETs to reinforce the European industrial base and competitiveness, whilst at the same time creating new jobs. In parallel, the new European industry policy communication of October 2012 has, identified KETs as three of the six priority areas for investment. The European Council has also underlined the importance of KETs to European economic competitiveness. The conclusions of the European Council of March 2012 called on the European Union to "strengthen ... key enabling technologies which are of systemic importance for the innovativeness of European industry and the whole economy". The forthcoming thematic European Council on Industrial policy in February 2014 will discuss progress on the European KETs Strategy implementation.

## European competitiveness in global manufacturing and KETs is declining

European Key Enabling Technologies and in particular, manufacturing, now face a tsunami of competitive and industrial threats from both Asia and the US. There is no longer any European manufacturer in the top three by share of global manufacturing. The lack of a level-playing field for Europe, along with significant market distortion, has resulted in Asian's rising up the top ranks of manufacturing displacing European Member States. This decade, is the first in four decades, where a European is not in the first 3 of the Top 15 manufacturers.

A specific case- study is the decline of European manufacturing base, illustrated by the machine tool industry sector. Between 2008 and 2012, the European share of the world market in machine tool equipment fell from 44 to 31%, a loss of 32% of its own global market share. In key strategic sectors such as batteries for green transportation, Asian dominance of manufacturing has increased in just two years from 87 to 93% of global production.

## If Europe loses manufacturing – Europe will lose its industrial and technological KETs R&D

Manufacturing accounts for and contributes disproportionately to innovation, private R&D KET spending and exports. The sector generates 70% of exports in major manufacturing economies and contributes to 77% of the private activities in R&D. To capture these economic benefits, countries must create and exploit comparative advantages (level the playing field) to convince the most globally competitive companies to participate in and grow their economies.

Moreover, it is increasingly recognized that as the complexity of the manufacturing increases, the industries need for innovation and the degree of the innovation required, dictate strong links between R&D and production and pushes companies toward co-locating R&D and production. In Asia, there is increasingly, co-location requirements of R&D and production. Therefore as Europe loses its manufacturing, it is progressively losing its industrial and technological R&D base.

## Europe is resilient in KETs patent share but the window of opportunity is reducing

Analysis of European Patent Office KET patent applications show that Europe remains firmly in competition with both the US and Asia. However, it also demonstrably underlines the relentless rise of Asian competencies in the KETs domains, with Asia now dominating EPO patent applications in Micro and nanoelectronics, Advanced Materials and Photonics.

## Rebalancing of European and Member State public investment from basic research to applied and development research is urgently required to compete with Asia and US

The US, China, South-Korea and Japan all focus at least 70% of their total public federal budget in applied and experimental development activities, with the remainder on basic research. In total contrast, the European commission currently allocates around 77% of its total research budget on basic research. The European Commission portfolio is critically unbalanced vis à vis other global competitor blocs. At Member States level, the High Level Group notes that Member State public investment on basic research rose from 36 to 43% of total investment over the period 2008 to 2010. In the context of the future Horizon 2020 implementation (2014-2020), a major rebalancing of resources allocated to innovation is necessary if the EU is to close the increasingly wide innovation and manufacturing gaps with its global competitors.

## KETs Implementation recommendations to the European Commission and Member States for a competitive Europe

During the past six months, the High Level group on KETs has focused on identifying the existing bottlenecks and potential solutions to rapid implementation of the new European Strategy for KETs and related industry policy aspects. Based on this analysis, the HLG-KET has made a series of implementation recommendations for a more effective industrial development and deployment of KETs across Europe. These implementation recommendations are given under two distinct thrusts: reindustrialising Europe by KETs innovation and KETs enablers to support





European competitiveness and jobs.

The context of reindustrialising Europe by KETs, is the ambitious objective of 20% of GDP coming from industry by 2020, put forward by the European Commission, in its "Industrial Policy for Growth and Economic Recovery" (October 2012). Key Enabling Technologies are an essential pillar in achieving this target. The HLG requests the European Commission as a matter of urgency to support the three priority actions and associated recommendations on reindustrialisation identified below:

#### **Implementing KETs and MutliKETs pilot lines (including demonstrators) in strategic industrial sectors**

Industrial pilot lines are at the core of the High Level Group on Key Enabling Technologies strategy for the reindustrialisation of Europe. Pilot lines enable the fabrication of a significant quantity of innovative prototypes arising from KETs. They are a critical step in securing future manufacturing on European sites. The challenge for the European Commission, Member States, regions and industry is to implement industrial KETs and Multi-KETs pilot lines in all strategic industrial sectors through the innovation-oriented public-private partnerships (PPPs). The feasibility of implementing such ambitious pilot lines in Europe, bringing together different funding sources and instruments (European national and regional), including industry and private sources should be addressed. Finally, European State Aid framework on R&D&I activities should be adapted to allow for a global level playingfield.

#### **Strengthening SMEs innovation capacity through access to early stage prototyping facilities**

SMEs are strategic for the European economy in creating jobs and advancing innovation and need to be better supported and accompanied in their innovation activities. Considering their difficulties to install their own or have access to early stage prototyping facilities - due to limited resources, business size and financial capacities- it is necessary to proactively support specific actions to promote and enable pan-European access to a set of technology platforms to accelerate the entry to the market of early stage KETs based prototypes enabled by SMEs in alignment with European supply chain.

#### **Anchoring a competitive global manufacturing and industrial landscape in Europe**

It is essential to create and maintain in Europe attractive economic environments in EU regions based on strong industrial eco-systems, comprising large and small companies. Only manufacturing facilities of a certain size can provide the means to integrate technologies and product development, to react to international competition, and to drive the rapid renewal and innovation cycles in the field of KETs-based products.

In parallel to the actions underpinning the reindustrialisation of Europe through innovation, the

High Level Group reiterates the need for an integrated and holistic approach to KETs. The HLG identified critical KETs enablers to support European competitiveness and jobs. Four priority actions and associated recommendations are highlighted:

#### **To develop KETs human capital and skills**

New technologies cannot be developed and brought to the market if the European work-force does not possess the necessary skills. In particular, a Europe wide education and training plan should be put in place. The weak support of individual excellence in KET related technological research should be addressed by ERC. A KIC on Advanced KETs-enabled Manufacturing should be launched in 2014 to meet the ambitious 20% of industry contribution to GDP by 2020.

#### **To protect and exploit European public funded intellectual assets**

In view of the new scope of European research and innovation programmes which will now also support activities which are closer to the market (as prototyping, piloting and demonstrating), it is important to pay more attention to the protection and exploitation of results from these EU funded activities. More particularly, in times where public money is scarce, project results should have a clear return on investment for the European economy to commit tax payers' money in line with the European growth and jobs agenda.

#### **To accelerate innovation and contribute to EU Industrial Policy stimulating European KETs market and supply in order to leveraging their contribution to solving societal challenges**

An Innovation dynamic can only be created if policies and projects on Societal Challenges include both dedicated demand side innovation measures and supply side innovation measures, along strong value chains in Europe, meeting sustainability criteria (use societal challenges push-and-pull). Societal Challenges are defined by very complex layers of interests of stakeholders from EU to local and individual levels. Clear decision processes with mandate and accountability are therefore needed. New formal and practical interlinks have to be established between the Horizon 2020 programme framing of Societal Challenges and Industrial Technology Leadership along KETs value chains.

#### **To promote KETs policies at national and regional level**

It is essential to create synergies between EU policies and instruments and ensure coordination of EU and national activities. The High Level Group highlights the need for Member States and regions to make best use of smart specialisation strategies and the instruments at hand to support the re-industrialisation of Europe and welcomes Member States and regions efforts to seek complementarity with European instruments.



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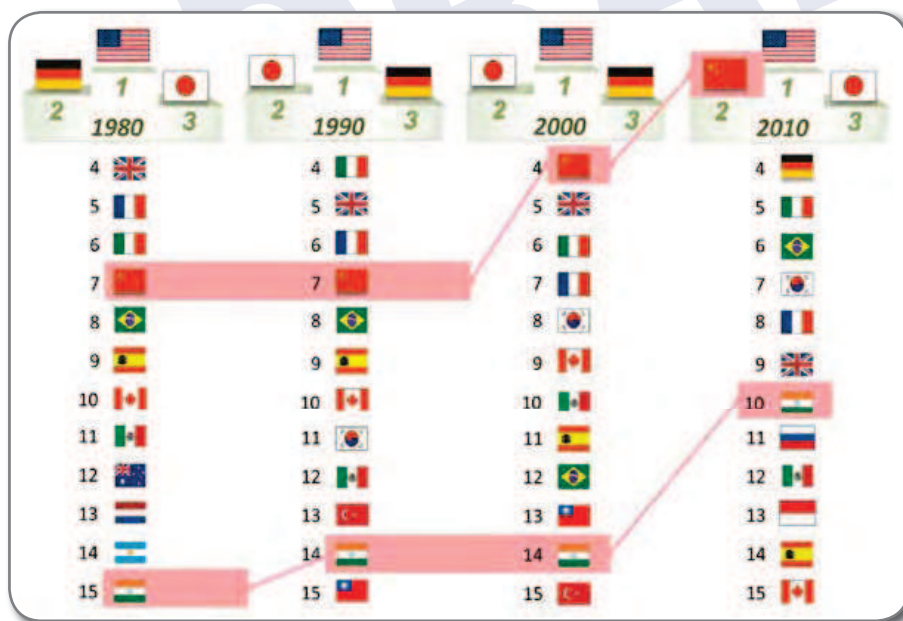
# CHAPTER 1: GLOBAL KETs PERSPECTIVE



Europe is mired in a deep crisis with several of its Member States in a prolonged recession. European Key Enabling Technologies and in particular, manufacturing, now face a tsunami of competitive and industrial threats from both Asia and the US. There is no longer any European manufacturer in the top three by share of global manufacturing. Between 2008 and 2012, the European share of the world market in machine tool equipment fell from 46 to 31%, a loss of 32% of its own global market share. Asian dominance of key strategic sectors such as batteries for green transportation has increased in just three years from 82 to 93% of global production. Manufacturing accounts for and contributes disproportionately to innovation and to 77% of private R&D KETs spending. In addition, as manufacturing increases in complexity there is increasingly, a co-location requirement of R&D and production. Therefore as Europe loses its manufacturing, it is progressively losing its industrial and technological R&D base. European R&D remains somewhat resilient but is weakening. European policy makers must therefore urgently take proactive measures to, not only retain the European KETs manufacturing base, but attract and take a world leadership role in manufacturing of advanced KETs enabled products.

## 1.1 EUROPEAN COMPETITIVENESS IN GLOBAL MANUFACTURING IS RAPIDLY DECLINING

The US is No.1 and has remained No. 1 over four decades in manufacturing<sup>1</sup> as demonstrably shown in Figure 1. As important, a new policy agenda for US manufacturing is now in place to not only ensure that the US retains its existing manufacturing but also *“sets the stage to lead the world in new technologies (robotics, nanotechnology, materials ...) and innovations that are changing the face of manufacturing”*<sup>2</sup>. In short, the US has recognized and acted on the importance of its KETs for a competitive America.



In parallel, large Asian economies are moving up all strategic industrial value chains. Due to ambitious policies and the lack of a level-playing field in Europe, Asian states have risen up the top ranks of manufacturing displacing European Member States such as Germany, United Kingdom and France<sup>1</sup> as highlighted in Figure 1 for China and India. This decade, is the first in four decades, where a European is not in the first 3 of the Top 15 manufacturers (Germany moved to the fourth place in 2010) as depicted in the Figure 1.

Figure 1.  
Top 15 Manufacturers by share of global manufacturing nominal gross value added

1. McKinsey Report. Manufacturing the future: the next era of global growth and innovation, November 2012.

2. "Making" our future - What's State Are Doing to Encourage Growth Manufacturing through Innovation, Entrepreneurship, and Investment, National Governors Association Policy Academy Report, January 2013.

A specific case- study<sup>3</sup> of this decline of European manufacturing is the machine tool industry sector highlighted in Box 1.

### Box1. Case study: Machine Tool

## "Once the manufacturing base is lost, it never comes back"

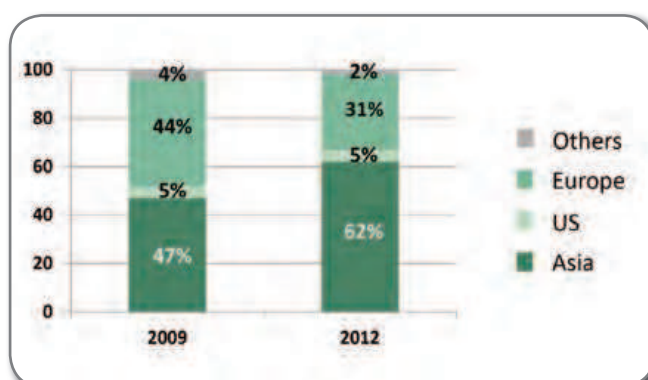


Figure 2.  
The share in Machine Tool production for the period 2009-2012

The ramp-up of manufacturing in Asia and the US is clearly evident with consumption increasing in both competitor blocs. Of significance is the almost doubling of equipment purchases in the US. In contrast, European machine tool consumption contracted by more than 31% between 2009 and 2012 to reach 17% of total share (Figure 3.).



European machine tool production has fallen from 44 to 31% of total market share between 2009 and 2012, as depicted in the Figure 2.

At the same time, the Asian share grew from 54 to 62% dominating the market of machine tool production with a China's share up to 45% of the worldwide consumption (comparing to 39% in 2009). The deteriorating business confidence in Europe is clearly reflected in the rapidly decreasing of machine tool consumption.

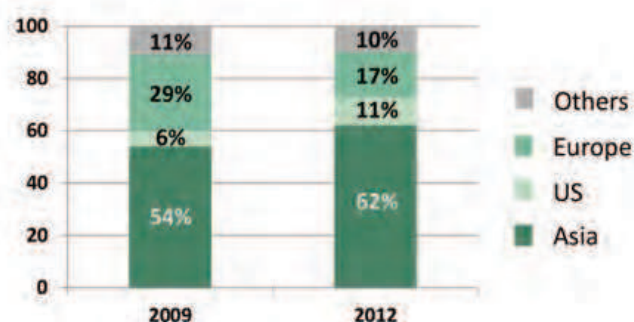


Figure 3.  
World Machine Tool consumption / geographical repartition for the period 2009-2012

3. Competitiveness of the European Machine Tool Industry Report, CECIMO, November 2011, Brussels.

In addition, other detailed case-studies in KETs related sectors confirm this decline. The first HLG report of 2011 highlighted the areas of Li-ion battery and photovoltaic cell production in Europe. In both cases, the situation has worsened dramatically, even over the short period of two years, as shown in Figures 4 and 5.

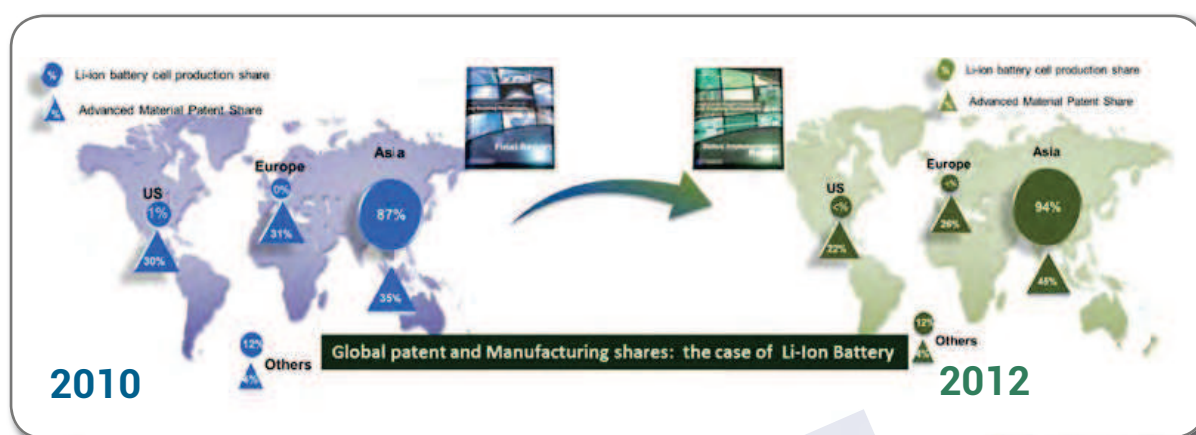


Figure 4.  
Global Patent and Manufacturing shares evolution: Case of Li-Ion Battery

The Asian share of Li-ion battery production increased from 87% in 2008 to 94% in 2012, and its share of photovoltaic cell manufacturing increased from 82 to 93%.

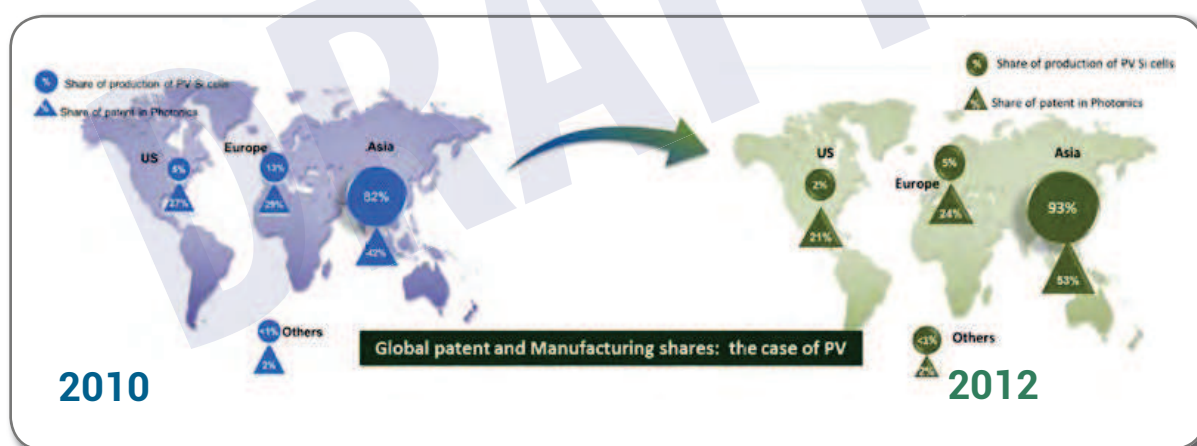


Figure 5.  
Global Patent and Manufacturing shares evolution: Case of PV

The Photovoltaic sector is also the example where Europe is still the largest world market (54% of the global market in 2012) but has singularly failed to sustain a European industry presence. The European photovoltaics manufacturing industry has essentially disappeared in just seven years due to unfair competition from Asian competitors<sup>4</sup> (see Box 2).

4. COMMISSION REGULATION (EU) No 513/2013 of 4 June 2013 imposing a provisional anti-dumping duty on imports of crystalline silicon photovoltaic modules and key components (i.e. cells and wafers) originating in or consigned from the People's Republic of China and amending Regulation (EU) No 182/2013 making these imports originating in or consigned from the People's Republic of China subject to registration.



The European market, is as a result, mainly supplied by Chinese cells and modules (in 2012, Asian industry had 93% of total production of Silicon PV cells and modules with €21 billion of photovoltaic product was exported from China into the EU). Seven Chinese companies are positioned in the top 10 ranking of global suppliers of PV modules in 2012. The last remaining European PV manufacturing company in the Photovoltaics Top 10 global manufacturers, the German “Q-Cells” was sold to an Asian purchaser in 2012.

### Box2. Europe’s competitive position in the area of KETs is undermined by international market distortion

A recent 2013 European Commission funded study<sup>5</sup> on International market distortion in the area of KETs has concluded that several competitor countries, including developing, emerging and mature industrial economies, provide significant incentives for investors in KETs manufacturing which EU Member States are not always able to match. The instruments used to attract investment by EU companies include a broad variety of the targeted policy instruments that governments can employ to attract high-tech (specifically KETs) investments. These included grants, fiscal incentives, soft loans and free land often provided in comprehensive ‘location packages’ offered by national or regional governments. The combined monetary value of such packages could run up to hundreds of millions of Euros. Third countries often proceed to bilateral negotiations with the European companies concerned which may result in additional advantageous terms – such incentives are usually not made public by the parties.



Another important ‘instrument’ identified, were the investment promotion agencies (IPAs) which were particularly effective in a number of Asian countries throughout the negotiation process, securing a fast decision-making process and reducing the administrative burdens laid upon the investing companies to an absolute minimum.

The study highlighted several examples of market distortion; two examples were found in the semiconductor industry, where third countries offered substantial incentive packages to leading EU companies. Such incentive packages can be worth up to 20-25% of an investment. Both cases concerned Asian countries, and the location packages contained a combination of grants, tax/duty exemptions, and free land, along with other incentives. Another case relied on an investment in the Biotech industry in the US where the company was awarded a substantial tax CREDIT. The tax CREDIT was granted on the basis of a formal application to a specific tax incentive programme under the American Recovery and Reinvestment Act.

In all examples cited in the report, where market distortion was demonstrated, a location in Europe was possible since the basic location factors (framework conditions) were in place, but the investment incentives were decisive for the selection of KETs investment locations outside the EU.

The overall above trend for global manufacturing and, detailed in particular for the three KETs case-studies, is further confirmed in a survey from more than 550 CEOs and senior manufacturing leaders<sup>6</sup>, stating that in 2018, emerging economy nations will surge to occupy the top three spots, with China first, and India and Brazil moving

5. Study on the International Market Distortion in the Area of KETs: a case analysis. ECSIP Consortium. 13 May 2013. Copenhagen.

6. 2013, Global Manufacturing competitiveness index. Deloitte Touche Tohmatsu Limited (Deloitte) and the U.S. Council on Competitiveness (Council).

up to claim the second and third rankings, respectively. The average manufacturing competitiveness index (out of a maximum nine) for Asia is estimated to significantly raise from 6.8 to 7.2 while US and EU index will decline from 7.9 to 7.7 and from 4.6 to 4.4, respectively.

## Lose manufacturing: You lose R&D

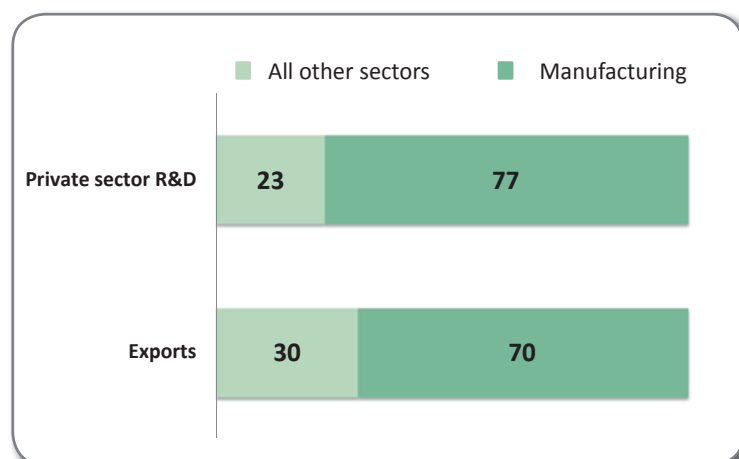


Figure 6.  
Manufacturing contributes disproportionately to exports, innovation, and productivity growth

Manufacturing makes a disproportionate contribution to both; innovation in terms of private sector research and development (R&D) and, exports, as shown in Figure 6. The sector generates 70% of exports in major economies and contributes to 77% of the private sector R&D (in certain sectors up to 90% of business R&D spending). To capture these economic benefits, countries must create and exploit comparative advantages (level the playing field) to convince the most globally competitive and productive companies to participate in and grow their economies.

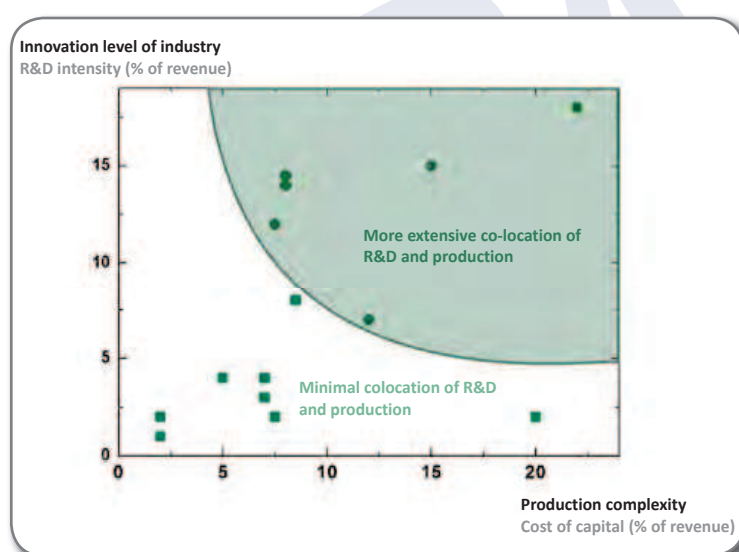


Figure 7.  
Complexity of production and level of innovation determine need for co-locating R&D and production

Moreover, it is now increasingly recognized that as the complexity of the production process (advanced manufacturing) increases, the industries need for innovation pushes companies toward co-locating R&D and production<sup>7</sup> (Figure 7).

As the critical role of manufacturing specifically, and the broader enabling role of KETs is increasingly recognized by the US and others, Europe must now reinforce its own capacities to invest in KETs to remain able to maintain and/or attract competitive companies and their large R&D activities in Europe.

7. McKinsey & Company and ProNET Survey of more than 100 managers at 54 manufacturing companies, McKinsey Report. Manufacturing the future: the next era of global growth and innovation, November 2012.

## 1.2 EUROPE IS RESILIENT - BUT THE WINDOW OF OPPORTUNITY IS REDUCING

Europe retains considerable assets in this global KETs competition. As stated in the first KETs High Level Group report of July 2011, from both research and industrial perspectives, these assets include a strong technological research base, as well as world leadership in several KETs application sectors (aeronautics, automotive, health and energy).

The most recent analysis of EPO/PCT patent applications shows that Europe remains firmly in competition with both the US and Asia (Figure 8). However, it also demonstrably underlines the relentless rise of Asian competencies in the KETs domains.

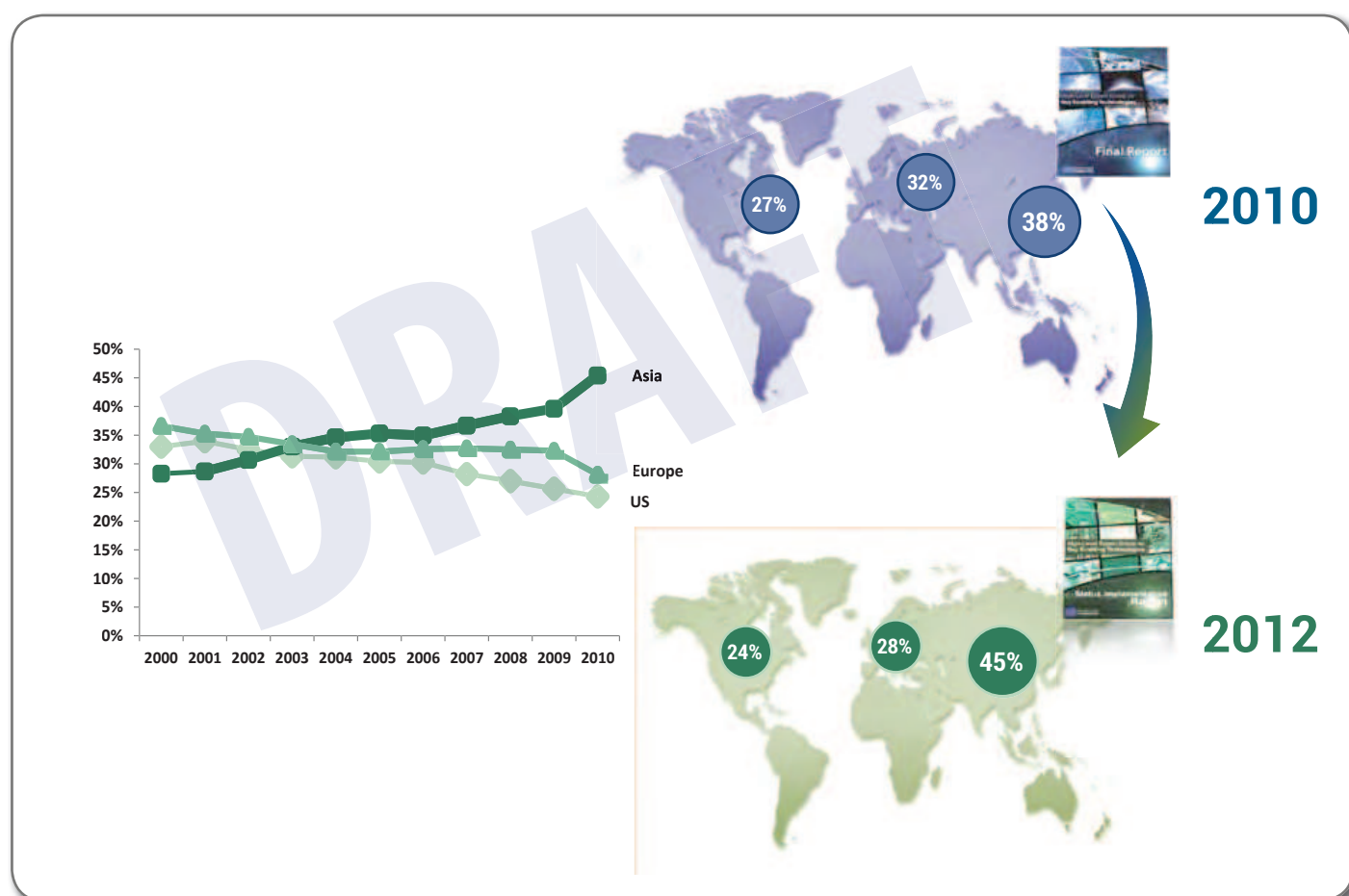


Figure 8.  
Share of EPO/PCT patents by region (all KETs cumulated) 2000-2010<sup>8</sup>

8. Source: Report 2010, European Competitiveness in Key Enabling Technologies (TNO/ZEW), TKM analysis, February 2013.



A more detailed analysis of patents in the six European KET priority technologies (Figure 9) shows that except in the area of nanotechnology, the European patent position is competitive with that of the US. However, Europe is confronted with an increasingly aggressive competition from Asia who now dominates EPO/PCT patent applications in microelectronics, advanced materials and photonics. Asian countries are raising rapidly their capacities to master and protect their KETs based innovation.

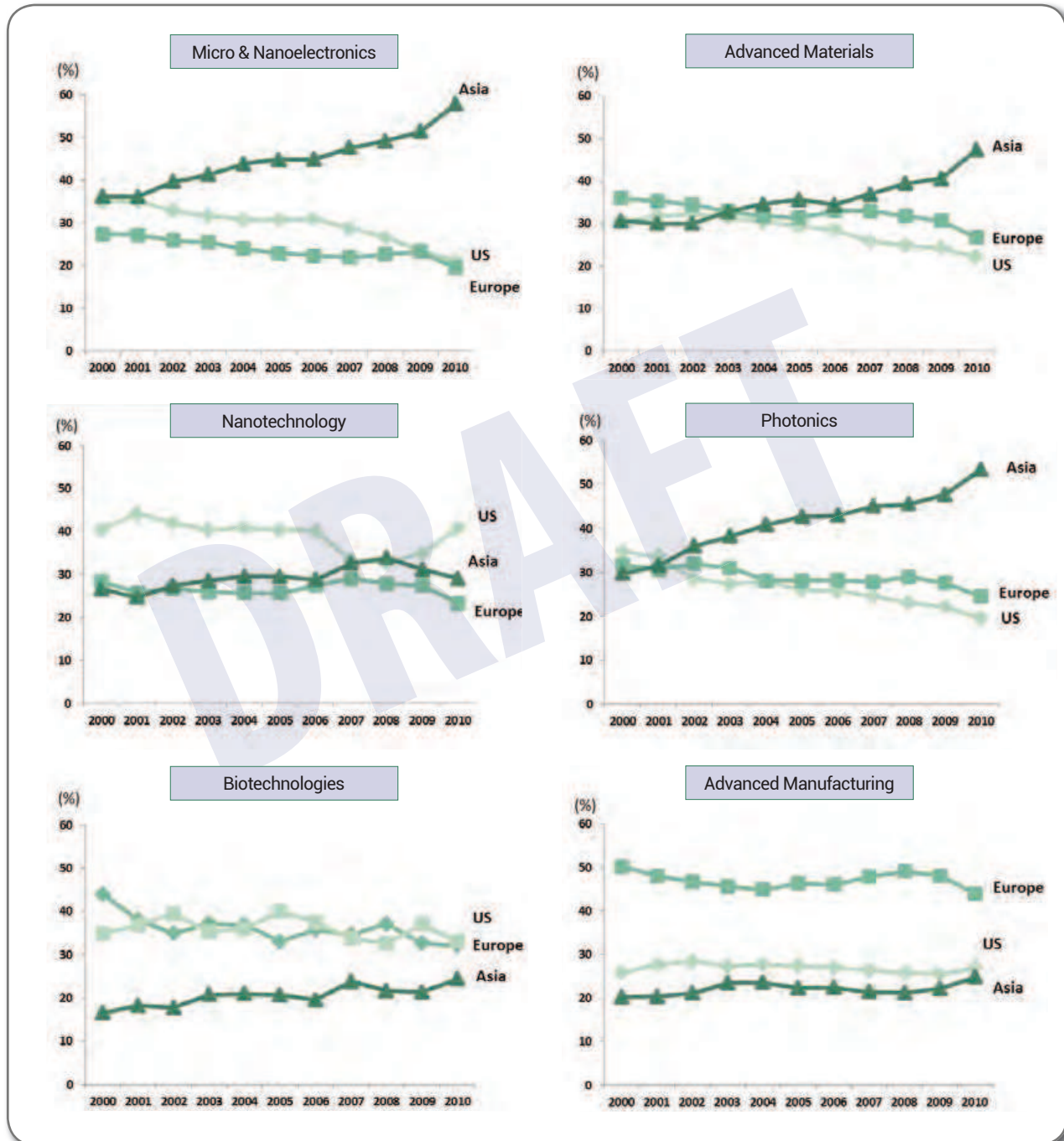


Figure 9.  
Share of EPO/PCT patents per geographic regions per KET.  
With regards to regional split :  
Europe includes all EU Member States as well as Albania, Andorra, Bosnia-Herzegovina, Croatia, Iceland, Liechtenstein, Macedonia, Monaco, Montenegro, Norway, San Marino, Serbia, Switzerland  
Asia, Japan, China (incl. Hong Kong), South Korea, Singapore, Taiwan  
With regards to Industrial Biotechnology, Biofuel, Biodiesel, Bioethanol have been also taken into account for collecting patents data

There is a clear disconnect between the leading position of Europe in terms of patent share for advanced manufacturing and the declining competitiveness of European industry in manufacturing. This example once again eloquently demonstrates the European KETs valley of death paradigm, namely the yawning gap between mastering knowledge and the European capacity to translate its innovation into goods and products.

At a more general level, Europe must proactively ensure that its European public funded intellectual property is a key asset for global competition. The High Level group notes that the diffusion and exploitation of European generated Intellectual Property Rights outside Europe is accelerating. The “Innovation Union Scoreboard 2013”<sup>9</sup> report demonstrated an average growth of license and patents revenues from abroad rising up to 6% in 2012 while it was only 0.3% in 2010, as illustrated in Figure 10. Europe must insure that its public funded intellectual property is exploited first in Europe.

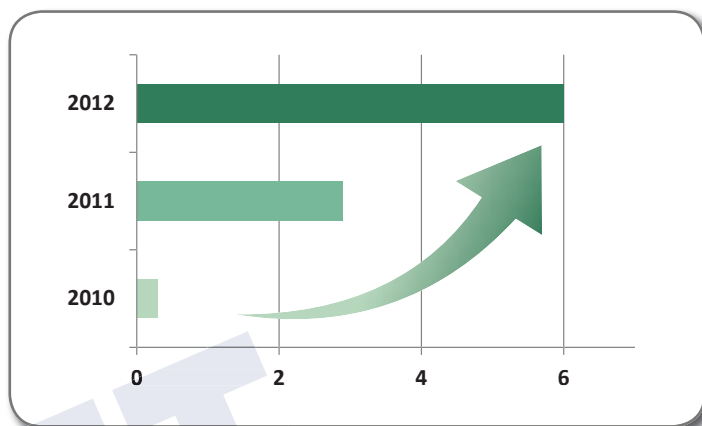


Figure 10.  
Average growth of license and patent revenues from outside Europe (%)

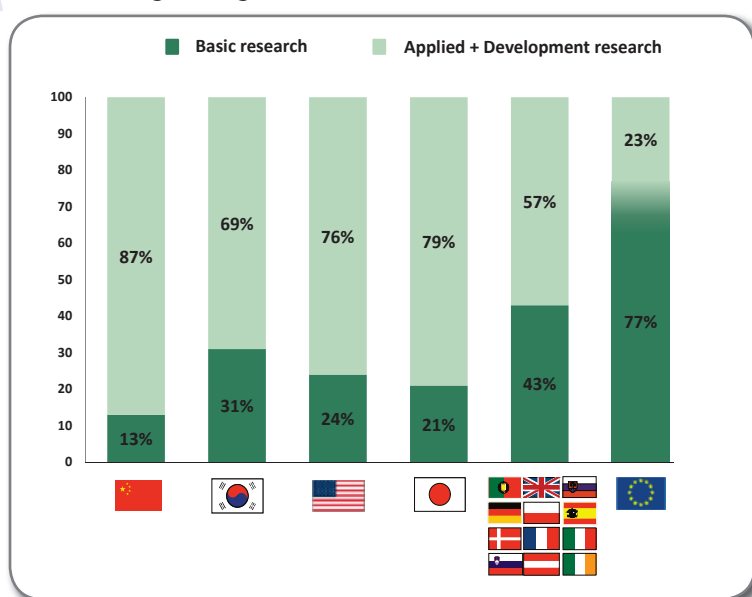
### 1.3 US AND ASIA INVEST MASSIVELY INTO DEVELOPMENT ACTIVITIES TO SUSTAIN THEIR INDUSTRIAL INNOVATION

The US, European Union (EU), and Asia continue to be the strongest regions for R&D&I, with a combined total of nearly 92% of all global spending<sup>10</sup>. However, over the past five years, the Europe share of global R&D spending has continuously declined, whilst US and Asian countries have dramatically increased their investment in close to market research.

China, South Korea, Japan and US currently direct at least 70% of their total public federal investment in R&D, for applied and development research, including R&D&I activities close to market, as displayed in Figure 11.

Figure 11.

Strategic focus on applied and development research public funding the case of US, China, South Korea, Japan, European Member States panel and EU 27<sup>11</sup>



9. Innovation Union Score board 2013. European Commission.

10. Science engineering indicators digest. National Science Board. NSF, January 2012.

11. OECD “Research and Development Statistics, Key Science and Engineering Indicators, National Science Board, Europa, Eurospair and Eurosearch”.

Europe, in contrast, still maintains a lone position with efforts critically unbalanced, spending more than two thirds of its total public European funding on basic research R&D&I activities.

Indeed, in spite the alarming diagnosis presented in the first report of HLG in 2011, the public investment on basic research amongst European Member States has continuously increased from 36 to 43% of total investment in R&D&I activities, between 2008 and 2010 as depicted in the Figure 12.

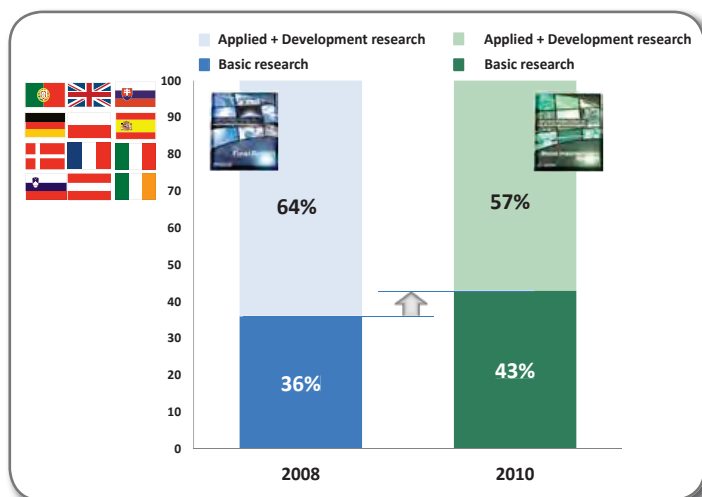


Figure 12.  
Evolution of public funding distribution on basic and applied/development research between 2008 and 2010 for a panel of European Member States



# CHAPTER 2:

## EU KETs POLICY LANDSCAPE IN THE EU

If Europe is to achieve its “Europe 2020” objectives and become a world leading sustainable, competitive and resilient economy, it will require the implementation of ambitious and coordinated R&D&I and industrial policies. KETs are crucial and represent three of six key innovation areas to boost growth, and job creation, in Europe, as emphasized in the 2012 EC communication on industrial policy<sup>12</sup>.

In June 2011, the first High Level Group on KETs proposed a set of recommendations to implement a strategy to further develop and deploy KETs in Europe. Since then, in response, various European policy initiatives on KETs have been adopted. The objective of the present chapter is therefore to review the emerging European KETs landscape and assess the status of implementation by the European Union (EU) of the first HLG KET recommendations.

## 2.1 THE EU KETs POLICY LANDSCAPE IN 2013

Since the launch of the first HLG KET in 2010, the implementation of a landscape favorable to KETs has gained considerable momentum. Owing to their enabling and systemic nature for the competitiveness of the European industry, KETs are now recognized as a cornerstone of European R&D&I and industrial policies. This increased political focus on KETs is reflected in the broad range of European areas and policies addressing KETs, from research and innovation to industrial, or Cohesion policies. In this respect, KETs are now integrated in various European policy initiatives as described below.

### Growing political focus on KETs by the European Commission:

#### An industrial policy in a globalization era

In its communication on Industrial policy in a globalization era<sup>13</sup> in 2010, the European Commission recognized that one of Europe's challenges is to *“urgently develop and bring to market Europe's research strengths in emerging technologies. Key enabling technologies such as industrial biotechnology, nanotechnology, advanced materials, photonics, micro- and nano-electronics, and advanced manufacturing systems can provide the basis for a wide variety of new processes and goods and services, including the development of entirely new industries over the next decade. Europe has a leading position in scientific research, but the timely deployment and take-up of these technologies throughout EU industry, including by SMEs, needs to be ensured. Closer cooperation on technology policies and programmes, better access to financing, and strengthened support for pilot and demonstration projects are essential to accelerate the development of commercial technologies”*. In this respect and subsequent domains of action, the European Commission acknowledged and engaged the need to *“launch an initiative to promote the wide and timely deployment, take-up and commercialization of competitive Key Enabling Technologies. [whilst ...] Member States were invited to foster closer cooperation between policies for key enabling technologies to maximize synergies and complementarities in technology deployment.”*<sup>14</sup>

12. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *A Stronger European Industry for Growth and Economic Recovery*, Brussels, 10.10.2012, COM(2012) 582 final.

13. “Making” our future - What's State Are Doing to Encourage Growth Manufacturing through Innovation, Entrepreneurship, and Investment, National Governors Association Policy Academy Report, January 2013.

14. Communication from the Commission, *An Integrated Industrial Policy for the Globalisation Era*, Brussels, COM(2010) 614.



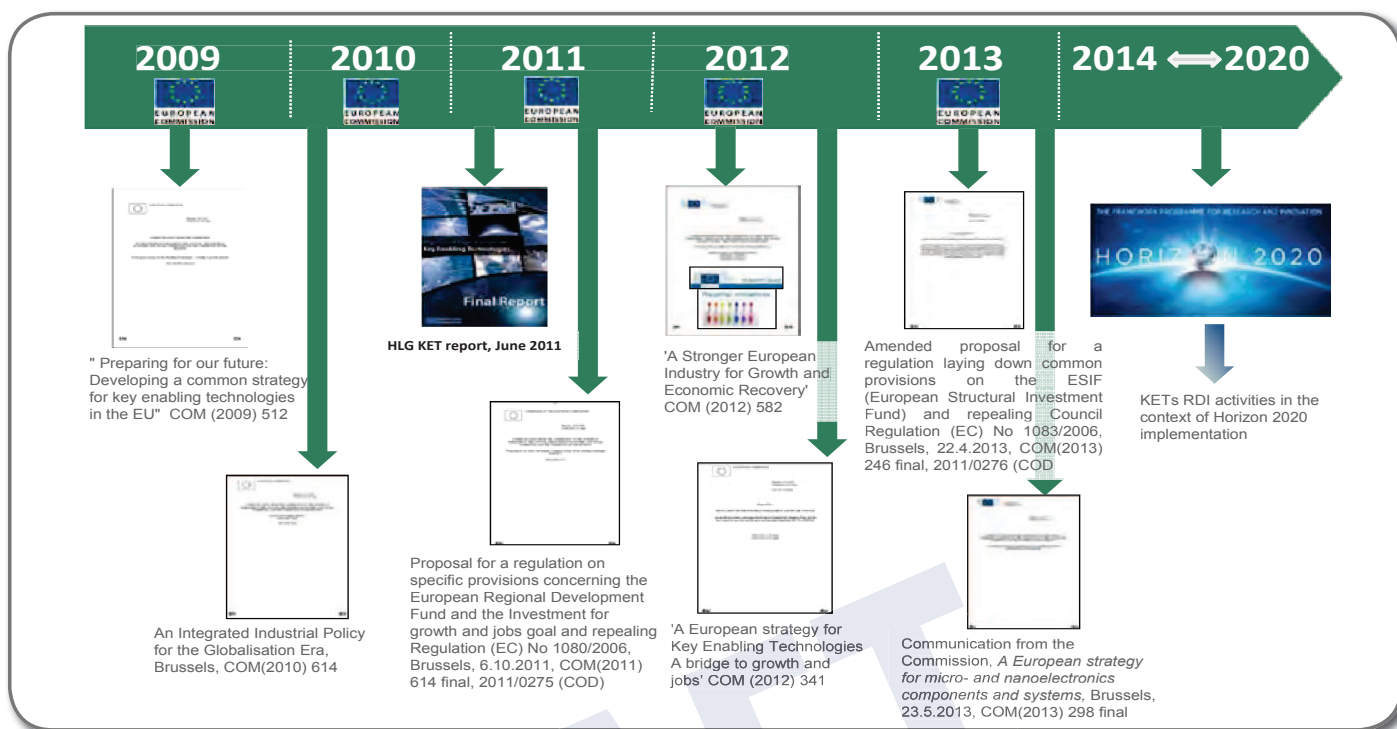


Figure 13.

*Political support to KETs within European R&D&I, industrial and regional policies*

In October 2012, in the updated European Commission communication on industrial policy<sup>15</sup>, KETs were identified as three of the six priority areas for investment of the European industrial policy<sup>16</sup>. The European Commission launched policy measures based on the following four pillars: investment in innovation (including the six priority lines), better market conditions, access to capital along with human capital and skills.

KETs are therefore now recognized as strategic for the competitiveness of European industry, as well as for the economic growth of our economy, and job creation. Europe needs to remain in the global race. This is reflected in the integration of KETs within three priority areas of the updated European industrial policy.

In this context, the European strategy on KETs, adopted by the EC in June 2012<sup>17</sup>, promotes an integrated approach comprising not only industry oriented issues, but also, R&D&I, State Aids, and financing issues in order to ensure the successful framework conditions at the European level.

## A European strategy on KETs

The *"European strategy for KETs – A bridge to growth and jobs"*, adopted by the EC in June 2012<sup>17</sup>, reiterates the strategic importance of KETs to reinforce the European industrial base and competitiveness, whilst at the same time creating new jobs. *"KETs are a key source of innovation. They provide indispensable technology*

15. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, *A Stronger European Industry for Growth and Economic Recovery*, Brussels, 10.10.2012, COM(2012) 582 final.

16. The 2012 EC Communication on industrial policy identified KETs as one of the six priority areas of the European industrial policy, along with advanced manufacturing technologies for clean production, bio-based products, sustainable industrial policy, construction and raw materials, clean vehicles and vessels as well as smart grids.

17. 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"*, Brussels, 26.6.2012, COM(2012) 341 final.

*bricks that enable a wide range of product applications, 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. [...] 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."* To fully exploit this potential, the EC proposed a strategy based on four main action lines to speed up the development and industrial deployment of KETs-based products through:

- the adaptation and streamlining of EU policy instruments;
- a better coordination of EU and Member States policies in order to achieve synergies and complementarities;
- the establishment of adequate and dedicated governance structures within and outside the Commission to ensure effective implementation and;
- the mobilization of existing trade instruments to ensure fair competition and a global level playing field.

### KETs in the Cohesion policy

Considering that KETs feed into many different industrial value chains and sectors, they represent a significant potential for European regions willing to boost both their traditional and high tech industries. In this respect, KETs have a major role to play in bringing growth to regions and reinforcing their competitiveness. In addition, due to the specificities of the various European regions, in terms of technology developers, suppliers and producers, KETs have a spill-over effect across regions in Europe.

KETs have therefore been identified by the EC as one of the investment priorities for regional innovation financing in its proposal on the future European Regional Development Fund (ERDF) . In particular, it will support *"technological and applied research, pilot lines, early product validation actions, advanced manufacturing capabilities and first production in Key Enabling Technologies and diffusion of general purpose technologies"*<sup>18</sup>.

By identifying KETs as one of its investment priorities in the ERDF, the European Commission has fully integrated these technologies in the context of the regional policy. This will create the favorable framework conditions allowing to leverage the KETs potential to unlock regional economies and industries, in the context of the smart specialisation strategies.

### Growing political support on KETs from the Council

Due to their transversal nature and systemic importance, KETs are now recognized as strategic for the competitiveness of the European industry and economy by the Council. This is more particularly reflected in the growing political support on KETs from the Competitiveness Council, as shown by the chart below and relevant conclusions on KETs. Firstly, the conclusions of the European Council of March 2012 called the EU to *"strengthen [...] key enabling technologies which are of systemic importance for the innovativeness of industry and the whole economy"*<sup>19</sup>. Similarly, the conclusions of the European Council of June 2012 reinforced this support by

18. Proposal for a regulation of the European Parliament and of the Council on specific provisions concerning the European Regional Development Fund and the Investment for growth and jobs goal and repealing Regulation (EC) No 1080/2006, Brussels, 6.10.2011, COM(2011) 614 final, 2011/0275 (COD).

19. Conclusions of the European Council, 1 and 2 March 2012, point 18, "Action at the EU level", p7.





recalling again the “particular importance to strengthen key enabling technologies which are of systemic importance for the innovativeness and competitiveness of industry and the whole economy, including in areas such nanotechnology, biotechnology and advanced materials”<sup>20</sup>. In October 2012<sup>21</sup>, the Competitiveness Council of the EU reinforced this statement calling for “further efforts to ensure that research efforts are swiftly translated into innovations meeting market demands and thus strengthen Europe’s competitiveness and help respond to societal challenges”.

Finally, a significant development is the organization of thematic Councils in the near future, as shown by the scheduling of next European Council on Innovation (in October 2013) and on Industrial policy (in February 2014). In this context, the enabling and transversal nature of KETs, strategic both for the European innovation and industry, will be further addressed.



Figure 14.  
Political support to KETs within the European Council

## Growing political focus on KETs within the European Parliament

In recent years, the European Parliament (EP) has delivered two resolutions on KETs. Firstly, in the resolution on “EU 2020 - Follow-up of the informal European Council of 11 February 2010”<sup>22</sup>, of the 10th of March 2010, the European Parliament (point 37) called “for a broad approach to future EU innovation policy; takes the view that key enabling technologies should receive adequate funding to make Europe a global leader in these areas”. Secondly, in its resolution on the “Industrial policy for the globalised era (2010/2095(INI)”<sup>23</sup> of the 9th of March 2011, the EP called “for the consistent use and reinforcement of available scientific and technological competencies in the Member States, particularly in key enabling technologies (KETs).” (point 42).

In complement to these resolutions, the EP’s growing interest on KETs has been demonstrated through its organization of several debates on KETs within the EP. Members of the EP have addressed the KETs issue within the ITRE Committee (Industry, Research, Energy), in Brussels, the 30th of August 2011, and the IMCO Committee

20. Conclusions of the European Council, 28 and 29 June 2012, part 3, “The contribution of European policies to growth and employment”, point e), p9

21. Competitiveness Council conclusions on Key Enabling Technologies and the European Innovation Partnership on Raw Materials (11 October 2012).

22. P7\_TA(2010)0053, EP resolution on Horizon 2020, 10 March 2010.

23. P7\_TA(2011)0093, EP resolution on an Industrial policy for the globalised era, 9 March 2011.

(Internal Market and Consumer protection), in Brussels, on the 20th March 2012. In addition, specific debates focused on KETs were organized, such as the "Knowledge 4 Innovation" forum of the EP called "Key Enabling Technologies - Catalyzer for Innovation and Growth" (Brussels, 31 May 2012), as well as a breakfast debate on "Smart specialisation for micro and nanoelectronics as a key enabling technology", the 28<sup>th</sup> of May 2013, in association with the Eniac Joint Undertaking.

KETs are therefore progressively been integrated within the EP political agenda. However, considering their strategic importance for the European economy and industry, and subsequent impact on the economic development of regions in the EU, additional effort are needed to better sensitize Members of the European Parliament on the strategic importance of KETs for the European economy and industry.

## 2.2 STATUS OF IMPLEMENTATION OF KETs RECOMMENDATIONS

In June 2011, the first High Level Group on KETs delivered to the European Commission a set of recommendations for a European integrated strategy on KETs development and deployment in the European Union. These recommendations built on six main lines as highlighted in Figure 15.

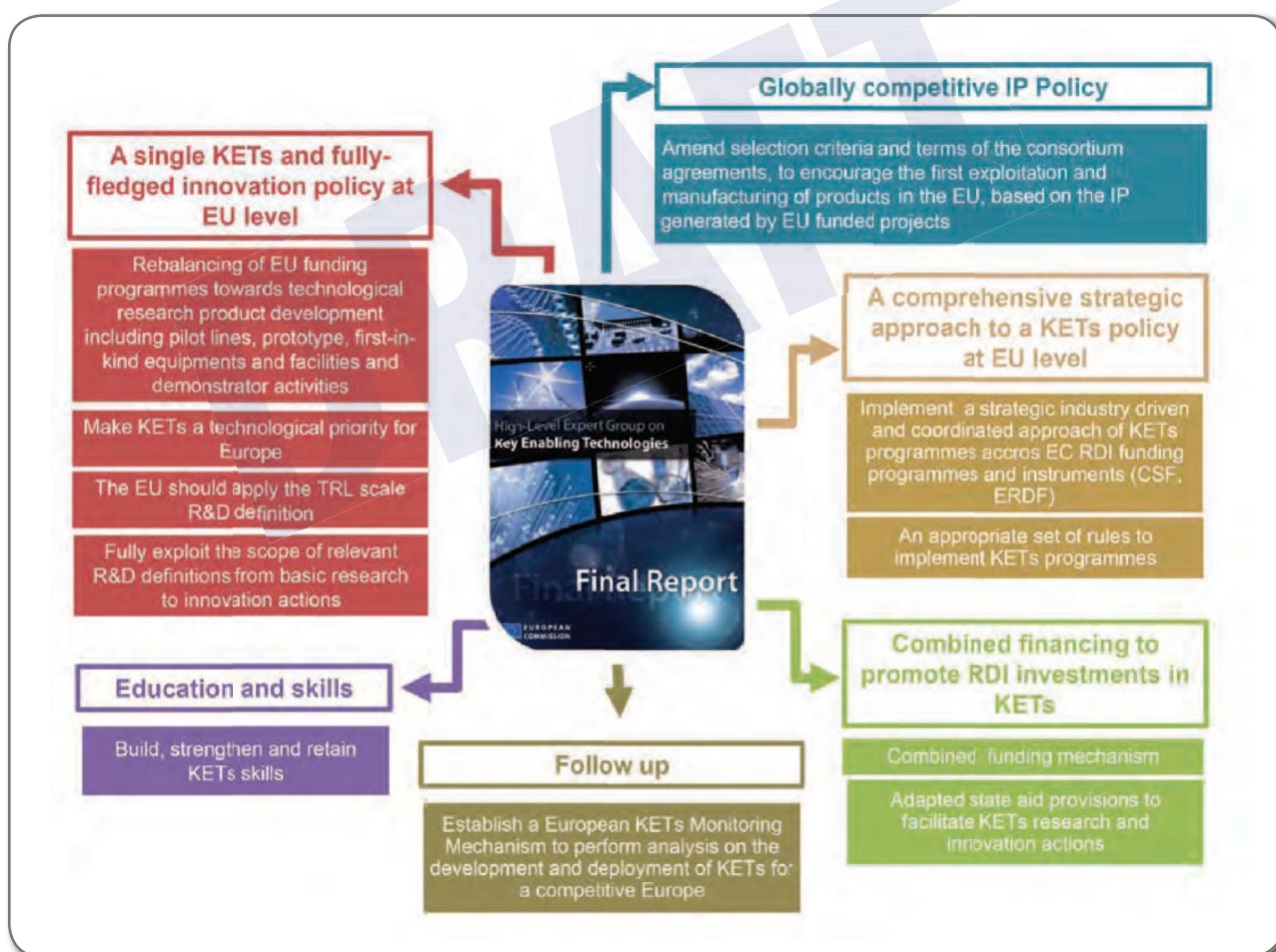


Figure 15.  
Recommendations of the first HLG KET Report (June 2011)<sup>24</sup>

24. The HLG First Report, June 2011, is available on the following EC website:  
[http://ec.europa.eu/enterprise/sectors/ict/key\\_technologies/kets\\_high\\_level\\_group\\_en.htm](http://ec.europa.eu/enterprise/sectors/ict/key_technologies/kets_high_level_group_en.htm)



Assessing the current implementation status requires focusing on the future European R&D&I program, Horizon 2020. Owing to the ongoing European negotiations and trilogue discussions on the future Horizon 2020, and subsequent potential development on same, this assessment is based on the official and public proposal from the European Commission on the Horizon 2020 regulation<sup>25</sup>. As further developed below, the EC has implemented a number of the HLG KET recommendations, is implementing others and is considering the remainders.

## HLG KET recommendations endorsed by the EU:

### A single KETs and fully-fledged innovation policy at EU level

The HLG KET recommended that *"an integrated KETs policy should be implemented, [...] that KETs should be visibly prioritised in EU policies and financial instruments and that the European Investment Bank group should pro-actively support KETs initiatives in Europe"* (Recommendation 1: Technological priority for Europe). In this context, several positive development are noted.

With respect to **making KETs a technological priority for Europe**, progress has been made in two areas. Concerning a dedicated budget for KETs activities in future Horizon 2020, the EC proposal<sup>26</sup> explicitly reflects the political will of the European Commission to make KETs a technological priority for Europe. This is demonstrated by the EC proposal on the future R&D&I budget within Horizon 2020 to create a specific KETs focus: *"Following on from recommendations made by the High Level Group on Key Enabling Technologies (KETs), 'Leadership in enabling and industrial technologies' will allow treating KETs as a key priority of Horizon 2020, highlighting their importance for growth and jobs. This includes a dedicated budget of EUR [...] million for the KETs of photonics, micro- and nanoelectronics, nanotechnologies, advanced materials, biotechnology and advanced manufacturing and processing. As part of this integrated approach to KETs, dedicated support will be provided for activities exploiting the accumulated benefits from combining a number of KETs, in particular through support for largescale pilot line and demonstrator projects."*<sup>27</sup>

In parallel, a growing support and engagement from EIB (European Investment Bank) on KETs has been demonstrated by the signature of a Memorandum of Understanding between the European Commission and the EIB the 27th of February 2013, in line with the European Commission communication adopted on the 26<sup>th</sup> of June 2012, on a *"European strategy for Key Enabling Technologies - A bridge to growth and jobs"*.

The European Commission and the European Investment Bank *"mutually acknowledge that KETs projects are of a systemic importance for improving the innovation performance of European industry and play an important role in contributing to sustainable competitiveness and growth. In this context, the EIB will recognize KETs as a priority in its 'Knowledge Economy' objective [...]"*<sup>28</sup>.

It is expected that the EIB capital increase of €10 billion will expand the bank's overall lending capacity by up to €60 billion, providing significant lending opportunities for KETs related capital-intensive projects.

25. Proposal for a council decision establishing the *Specific Programme Implementing Horizon 2020 - The Framework Programme for Research and Innovation* (2014-2020), Brussels, 30.11.2011, COM(2011) 811 final, 2011/0402 (CNS).

26. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Horizon 2020 - *The Framework Programme for Research and Innovation*, Brussels, 30.11.2011, COM(2011) 808 final.

27. 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"*, Brussels, 26.6.2012, COM(2012) 341 final.

28. Memorandum of Understanding between the European Commission and the European Investment Bank in respect to their cooperation in Key Enabling Technologies (KETs) according to Communication COM (2012) 341 final. 27 February 2013, Brussels.

Regarding the full exploitation of the scope of relevant R&D definitions, the HLG KET recommended the EC to "apply R&D&I definitions in its programmes which support the full and simultaneous implementation of the 'three pillar bridge' model along the innovation chain, from basic research, through technological research, product development and prototyping up to globally competitive manufacturing." (Recommendation 3: Fully exploit the scope of relevant R&D&I definitions).

In its proposal on future Horizon 2020 programme<sup>29</sup>, the European Commission explicitly addressed the need to support the whole cycle of the innovation chain activities, and in particular, to cover frontier and applied research, knowledge transfer and closer to the market activities including "larger-scale pilot line and demonstrator projects".

In the context of Horizon 2020, this transition towards closer to market activities is clearly displayed in the new microelectronics strategy<sup>30</sup>, which mainly supports "capital-intensive actions such as pilot lines or large scale demonstrators at higher Technology Readiness Level up to level 8." This is shown schematically in Figure 16.

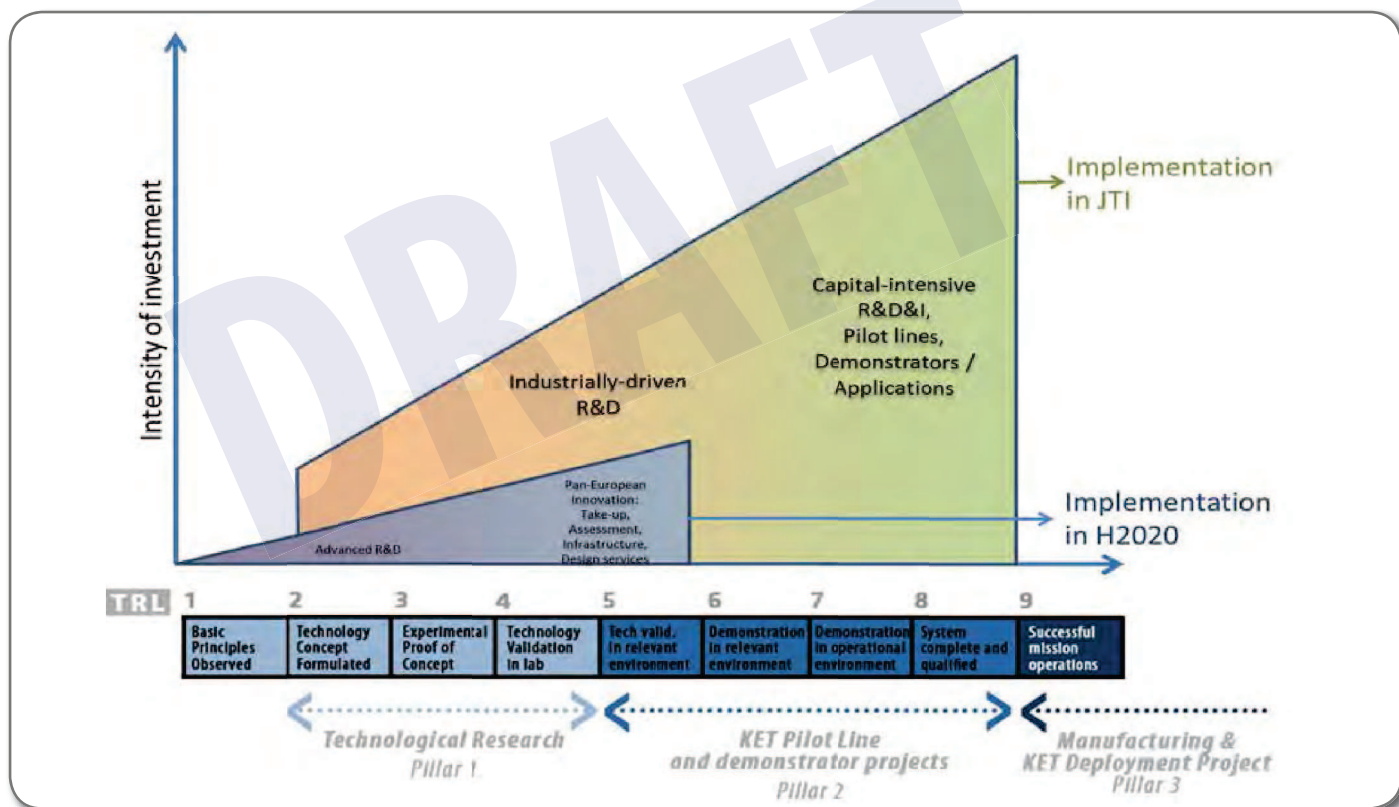


Figure 16.

A European strategy for micro- and nanoelectronics components and systems -COM(2013) 298 final

29. Proposal for a council decision establishing the *Specific Programme Implementing Horizon 2020 - The Framework Programme for Research and Innovation* (2014-2020), Brussels, 30.11.2011, COM(2011) 811 final, 2011/0402 (CNS).

30. 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 micro- and nanoelectronics components and systems*, Brussels, 23.5.2013, COM(2013) 298 final.



In parallel to the positive evolution of Horizon 2020, it is noted that in the regulation<sup>31</sup> on specific provisions concerning the European Regional Development Fund, an investment priority related to the *“strengthening of research, technological development and innovation”* explicitly covers the whole innovation chain activities up to the first production. In particular, it will support *“technological and applied research, pilot lines, early product validation actions, advanced manufacturing capabilities and first production in Key Enabling Technologies and diffusion of general purpose technologies”*.

### A comprehensive strategic approach to a KETs policy at EU level

Concerning an integrated and strategic approach to KETs, progress has been made in two areas. With regard to the cross-cutting dimension, the HLG KET recommended to the EC to *“define and implement a strategic, industry driven and coordinated approach to KETs programmes across EC R&D&I funding programmes and instruments (CSF, ERDF)”* (Recommendation 5: A strategic approach to KETs programmes). In this respect, several positive steps have been taken.

In its proposal on future Horizon 2020 programme<sup>32</sup>, the European Commission explicitly highlighted the need for an integrated approach on KETs, considering *“the accumulated benefit from combining a number of enabling technologies. [...] Tapping into cross-cutting key enabling technologies will enhance product competitiveness and impact. The numerous interactions of these technologies will therefore be exploited”*. Through this integrated approach, the EC has therefore recognized both the benefits and the need to promote such cross-fertilization processes, currently considered as “multi-KETs” activities. However, this principle remains to be reflected in the implementation of future Horizon 2020 programmes across all relevant DGs. In particular, it will be of considerable importance to ensure that the EU support on these multi-KETs activities is dedicated to higher TRLs (5 to 8), considering the increased need for technology integration at this step of the innovation chain.

This proposal was subsequently confirmed by Commissioner for Research, Science and Innovation, in her introductory speech to the new High Level Group on KETs kick-off meeting, on the 27th of February 2013, stating that while the bulk of financing will be allocated to individual technologies, a significant amount (around 30%) will be earmarked for research and innovation linked to two or more KETs.

In respect to governance aspects within the EC, in the context of future Horizon 2020, the need for a strategic approach is also clearly addressed by the EC Strategy on KETs from June 2012, proposing the set-up of *“an interservice group ensur[ing] 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)”*. This topic is also explicitly addressed by the EC in its proposal on future Horizon 2020, related to the need for *“a dedicated governance structure, [and to develop] a joint work programme for cross-cutting KETs activities”*<sup>32</sup>.

### Combined financing to promote R&D&I investments in KETs

The HLG KET recommended *“that the EU should introduce a tripartite financing approach based on combined funding mechanisms involving Industry, Commission, and national authorities (Member States and local government), when required by the high costs of the KETs R&D&I projects, and put in place mechanisms to allow*

31. Proposal for a regulation of the European Parliament and of the Council on specific provisions concerning the European Regional Development Fund and the Investment for growth and jobs goal and repealing Regulation (EC) No 1080/2006, Brussels, 6.10.2011, COM(2011) 614 final, 2011/0275 (COD).

32. Proposal for a council decision establishing the *Specific Programme Implementing Horizon 2020 - The Framework Programme for Research and Innovation* (2014-2020), Brussels, 30.11.2011, COM(2011) 811 final, 2011/0402 (CNS).

*the combination of EU funding (CSF, structural funds), to enable the optimum investment in significant KETs pilot line and manufacturing facilities across Europe” (Recommendation n°7: Combined funding mechanisms).*

Several positive steps have been taken in this direction. According to the article 55 of the Common provisions on Structural Funds<sup>33</sup>, under the next Regional Policy regulation (2014-2020), a project supported by ERDF will be authorized to combine funding from another Union instruments, including, Horizon 2020: *“an operation may receive support from one or more CSF Funds and from other Union instruments, provided that the expenditure item included in a request for payment for reimbursement by one of the CSF Funds does not receive support from another Fund or Union instrument, or support from the same Fund under another program”.*

The importance of this synergy, and the necessary articulation and coordination not only between the different European policies, but also, between European, national and regional policies was further emphasized by the Competitiveness Council in its conclusions<sup>34</sup> of October 2012, mentioning *“the importance of an integrated approach towards KETs, which strengthens synergies between relevant EU policies and instruments related to research, development and innovation, especially Horizon 2020, structural funds, including the European Regional Development Fund, as well as the European Investment Bank”.*

However, further efforts are urgently required to enable the concrete implementation of such combined funding mechanisms in future Horizon 2020 and ESIF actions.

### Follow up

The HLG KET has emphasized the need to *“establish a European KETs Monitoring Mechanism tasked with the mission of performing analysis [...] (on) the development and deployment of KETs for a competitive Europe”.*

This recommendation was further endorsed by the Competitiveness Council, in its Conclusions on KETs<sup>34</sup> welcoming *“the introduction of a monitoring mechanism for KETs in 2013, which is to be operated by the Commission and which will provide market data on the supply of and demand for KETs in the EU and other regions”.*

The recommendation was implemented by the Commission, firstly through the launching of a KETs Observatory, in 2012, and most recently, through the mobilisation of the JRC, in 2013, addressing the mapping of KETs R&D&I activities within the context of smart specialisation.

### HLG KET Recommendations: implementation in progress

Since the publication of its first report, as reviewed above, several HLG KET recommendations were endorsed and some of them, implemented, by the European Commission in number of policy initiatives. In parallel, some

33. *Common provisions on Structural Funds*, chapter II, Eligibility of expenditure and durability, article 55, Brussels, 22.4.2013, COM(2013) 246 final , 2011/0276 (COD).

34. Competitiveness Council conclusions on Key Enabling Technologies and the European Innovation Partnership on Raw Materials (11 October 2012).



HLG KET recommendations have not yet been fully implemented, but are still in progress, more particularly, in the context of the current negotiations on the future Horizon 2020 programme. These recommendations are discussed below.

### A single KETs and fully-fledged innovation policy at EU level

Regarding the **application of the TRL scale R&D definition**, the HLG KET recommended the EU *“to align its R&D activities on the TRL scale in line with the OECD definition”*. The Commission was also invited to *“systematically apply this definition in order to include technological research, prototype product development and demonstration activities within its R&D&I portfolio”* (Recommendation 2: The EU should apply the TRL scale R&D definition). In response, it is recognised that within its KETs Strategy, the EC refers to the TRL scale through an indicative scheme presented in the appendices of the EC communication<sup>35</sup> and reproduced below. In addition, as previously outlined, in its communication on the microelectronics strategy<sup>36</sup>, the EC explicitly uses the TRL scale definition in its plan that the JTI ENIAC will *“support capital-intensive actions such as pilot lines or large scale demonstrators at higher Technology Readiness Level up to level 8”*.

Nevertheless, beyond these positive first steps, it is noted that TRLs scale are not yet applied systematically to position the R&D&I actions supported by European instruments or calls over the pre-competitive innovation chain in the range of TRL 1 to 8.

In fact, there is currently no requirement to state the TRL scale covered by proposed future PPPs, other instruments or calls for proposal. The European Council and the EP can request such a modification to be included in the legal basis. This recommendation can in any case still be implemented in the context of the establishment of the various work programmes. This should be encouraged.

With respect to **the rebalancing of EU R&D&I funding programmes**, the HLG KET has recommended *“the EU and Member States [to] firmly rebalance their R&D&I funding in KETs related programmes towards technological research, the development of prototypes, pilots lines, first-in-kind equipment and facilities and demonstrator activities. In particular in the future CSF, the EU should set indicative targets for the percentage of funding dedicated to basic research, technological research and development activities”*.

In this respect, the agreed Horizon 2020 budget proposal by the European Council on the 27<sup>th</sup> of June 2013, does not represent a radical shift towards funding investments strategic for the future, such as KETs R&D&I. In addition, a clear allocation of EC Horizon 2020 budget across the Frascati OECD definitions remains elusive.

### An integrated and strategic approach to KETs

The successful implementation of the European strategy on KETs development and deployment<sup>35</sup> strongly relies on the capacity of the EU to develop an integrated approach, allowing to effectively translate research

35. 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”*, Brussels, 26.6.2012, COM(2012) 341 final.

36. 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 micro- and nanoelectronics components and systems*, Brussels, 23.5.2013, COM(2013) 298 final.



and technology development into marketable products and economic growth. In this respect, the European Commission recognized the driving role of public-private partnerships (PPPs) and identified these industry-driven instruments as *"an effective way of implementing this approach"*. The European Commission therefore 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."* Today, this political will still needs to be reflected in the concrete implementation of future Horizon 2020 programmes.

With respect to an **appropriate set of rules to implement KETs programmes**, the HLG KET recommended *"that the European Commission adapts its selection criteria and implementation rules in the CSF programme to maximise its impact on the value and innovation chains. In particular, a "value chain correctness" criterion should be added"*. This "value chain correctness" criterion has not yet been applied in a systematic way.

### Combined financing to promote R&D&I investments in KETs (State Aids)

The first HLG KET report recommended the EC to *"adapt State Aid provisions to facilitate R&D&I activities and large-scale investment in KETs, in particular through the introduction of a matching clause in the EU State Aid framework across the board, increased thresholds for notifications, faster procedures and the use of projects of common European interest."*

In this regard, the EC stated *"its intention to modernise State Aid rules, as announced in its Communication on State Aid Modernisation, 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"*<sup>37</sup>.

In parallel, the Competitiveness Council on KETs<sup>38</sup> called on *"the Commission to take full account of the potential impact of State Aid rules on the EU's competitiveness vis-à-vis the rest of the world and on the internal market, in particular when modernising its State Aid rules on research, development and innovation in view of an all inclusive debate on the administration of State Aids"*.

In view of such very positive support, in the context of ongoing discussions on a new State Aid R&D&I framework, the HLG KET awaits the taking into account of same in the EU R&D&I State Aid Framework.

### HLG KET Recommendations not yet adopted by the Commission

#### Globally competitive IP Policy

The exploitation of Intellectual Property (IP) is crucial not only for the maintaining and development of knowledge and know-how in Europe, but also, to attract subsequent manufacturing activities, source of growth, economic added value and job creation in Europe. The first HLG KET report therefore recommended the EC to implement a globally competitive (IP) policy. The objective was to ensure that European public fund generates a return on

37. 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"*, Brussels, 26.6.2012, COM(2012) 341 final.

38. Competitiveness Council conclusions on Key Enabling Technologies and the European Innovation Partnership on Raw Materials (11 October 2012).





investment in favour of growth and jobs, by protecting EU funded IP, and favoring exploitation of IP in Europe, under reasonable conditions. More precisely, the HLG KET requested the amendment of the *“selection criteria and terms of the consortium agreements of EU R&D&I funding programmes [...] to ensure that participating consortia have a clear and explicit plan for both the ownership of and first exploitation of IP resulting from the project within the EU”*. This aimed at encouraging *“the first exploitation and manufacturing of products based on this IP within the EU”*, inviting the EC to *“explicitly include provisions similar to those of the ‘Bayh-Dole Act’ and ‘Exception Circumstances’-like provisions [...]”* (Recommendation n°9: Globally competitive IP policy in Europe).

In this domain, the EC proposals on Horizon 2020 participation and dissemination rules<sup>39</sup> (article on “exploitation and dissemination of results”, article 40, point 1, and article 41 on “transfer and licensing of results”) remain elusive and do not encourage the first exploitation of IP in Europe, by participants receiving EU funding. Further efforts will be of high importance for Europe in this domain, in the implementation of future Horizon 2020 R&D&I activities, in order to ensure that EU public funded projects generate economic impact for the EU first.

## Education and skills

New technologies cannot be developed and brought to the market if the European work-force does not possess the necessary skills. In addition, the rapidly growing markets in KETs related sectors require an increasing number of professionals at all technical levels and in different disciplines. In this respect, the first HLG KET report noted that Europe is facing a damaging shortage of skilled labor, qualified to master the multi-disciplinary nature of KETs.

The HLG KET therefore recommended addressing this issue by inviting the EC to *“create a European Technology Research Council (ETRC) to promote individual excellence in technologically focused engineering research and innovation and [to] establish the appropriate framework conditions through the ESF regulation in order to support KETs skills capacity building at regional level”*.

In its 2012 communication on a European KETs strategy<sup>40</sup>, the EC acknowledged this KETs skills shortage and proposed relevant actions to respond to this issue such as the will *“to 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 [...] to develop partnerships between education and business such as Knowledge Alliances for 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”*.

The October 2012 Competitiveness Council conclusions<sup>41</sup> further emphasized *“the importance of training activities aimed at improving multidisciplinary skills in KETs based manufacturing”*.

39. Proposal for a regulation of the European Parliament and of the Council laying down the rules for the participation and dissemination in 'Horizon 2020 – the Framework Programme for Research and Innovation (2014-2020)' Brussels, 30.11.2011, COM(2011) 810 final, 2011/0399 (COD) P30-31 Title III, rules governing dissemination of results.

40. 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”*, Brussels, 26.6.2012, COM(2012) 341 final.

41. Competitiveness Council conclusions on Key Enabling Technologies and the European Innovation Partnership on Raw Materials (11 October 2012).

However, whilst the KETs skill shortage is now fully recognized by the EU, concrete actions in this domain remain elusive. The lack of a consistent KETs education and skills plan is demonstrated in the proposed scheduling of the launch of a Knowledge and Innovation Community on Added-Value Manufacturing addressing the combination of multiple key enabling technologies, for at best 2016, in the midst of a European wide manufacturing skills deficit and recession.

### **Conclusion:**

KETs are being progressively integrated in the political agenda of the EU. Significant progress has been noted regarding the implementation of the first HLG KET recommendations. However, further additional initiatives are required in order to create in Europe the successful conditions for KETs development and deployment.

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## CHAPTER 3: RECOMMENDATIONS

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### 3.1 REINDUSTRIALISING EUROPE BY KETs INNOVATION: THREE PRIORITY ACTIONS

The European Commission, in its *Industrial Policy for Growth and Economic Recovery*<sup>42</sup>, has put forward an ambitious manufacturing target to raise the share of its industry contribution to GDP to as much as 20% of GDP by 2020, communication. Support to and investments in Key Enabling Technologies (KETs) are essential in achieving this target. The HLG therefore recommends the European Commission to support, as a matter of urgency, the following actions on reindustrialisation through KETs innovation, in line with competition rules. It also invites private stakeholders to incorporate KETs-based products into their business strategies to enhance the deployment of KET-based products in the EU.

#### Accelerating product development and manufacturing capabilities in Europe through pilot lines (including demonstrators)

For Europe to succeed in this innovation strategy through pilot lines, it must address the following three priority actions and associated recommendations:

- Implementing KETs pilot lines (including demonstrators) in strategic industrial sectors;
- Allow combined funding mechanisms and seek compatibility of applicable rules;
- Adapt the Community R&D&I State Aid framework.

#### Implementing KETs industrial pilot lines (including demonstrators) in strategic industrial sectors and value chains

Industrial pilot lines are at the core of the High Level Group on Key Enabling Technologies strategy for the reindustrialisation of Europe. Pilot lines enable the fabrication of a significant quantity of innovative prototypes arising from KETs and allow prototype product test, qualification and validation, in terms of its user performance, at appropriate scale. They are a critical step of the innovation process in securing future manufacturing on European sites. The introduction of industrially based pilot lines has been successfully demonstrated within the ENIAC Joint Technology initiative (JTI)<sup>43</sup>. The challenge for the European Commission, Member States, regions and industry is to implement industrial pilot lines in all KETs and strategic industrial sectors. In parallel, demonstration activities in industrial facilities are essential to develop industrial processes for intermediate products in particular in the biotechnology and advanced manufacturing industries. Innovation-oriented public-private partnerships (PPPs) have been identified as effective tool to deliver this approach<sup>44</sup>.

42. A Stronger European Industry for Growth and Economic Recovery. Industrial Policy Communication Update' Brussels, 10.10.2012, COM(2012) 582 final.

43. The ENIAC Joint Undertaking (JU) is a public-private partnership focusing on nanoelectronics that brings together ENIAC Member/Associated States, the European Commission, and AENEAS, an association representing European R&D actors in this field-<http://www.eniac.eu>

44. 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', Brussels, 26.6.2012, COM(2012) 341 final, p.8-9





### Basics of KETs pilot lines

Industry involvement in KETs "and multi-KETs" pilot lines is a necessary condition to ensure the full exploitation of R&D&I outputs in manufacturing and industrial processing activities in Europe. Consequently, the Commission as well as Member States and Regions are requested to carefully take into consideration the leading role of European industry in the KETs pilot lines, demonstrators and any up scaling activity, over the Technology Readiness Level (TRL) range 5 to 8<sup>45</sup>. In order to be considered a KETs pilot line dedicated to KET industrial innovation, the following criteria should be complied with:

- generating knowledge and expertise about the behavior and performance of equipment, materials and processes, components, sub-systems and systems, at a scale that allows conclusions on later large scale industrial deployment;
- generating manufacturing samples or first industry prototypes for qualification and test purposes;
- addressing one or more European strategic value chains.

With regard to KETs pilot line projects, specific Selection criteria for EU public support should be observed, taking into account their proximity to the market and the commitment of industry to amplify economic and growth impacts in Europe. A non-exhaustive list of such requirements and stakeholder commitments is given below:

- Industrial company with significant potential for manufacturing in the EU<sup>46</sup>;
- Technology leadership;
- Impact on societal challenges;
- EU added value;
- Potential for creating manufacturing jobs in Europe;
- Commitment from industry: first exploitation in Europe (under reasonable circumstances) of results of close-to-the-market research generated IP;
- Involvement of industry partners including SMEs along a substantial part of the value chain;
- Accessibility of pilot line for appropriate skills development / education training while protecting IP;
- Avoid potential market distortion within the EU internal market of the KETs pilot line in accordance with the EU competition rules.

#### Recommendation 1: Implementing pilot lines (including demonstrators)

The High Level Group recommends that the European Commission as well as Member States and regions stimulate the reindustrialisation of Europe by accelerating product development and manufacturing capabilities in Europe and, supporting the implementation of industrial pilot lines (including demonstrators), in all KETs and in strategic industrial sectors and value chains, with the strong commitment of industry.

45. TRL 5: technology validation in relevant environment, TRL 6: demonstration in relevant environment, TRL 7: demonstration in operational environment, TRL 8: system complete and qualified.

46. HLG KET 1st report, June 2011



**Andreas Wild,**

*Executive Director of the ENIAC joint undertaking*

#### How did the pilot line scheme evolve, and how it is working?

Our role at ENIAC is to provide European funding to research projects. We are an EU body and our charter is to increase and leverage private and public funding in nanoelectronics. Nanoelectronic's is one of Europe's KETs because it provides the 'smart' components of almost anything. The HLG KET asked me to discover what sort of pilot line projects were feasible. In order to demonstrate the potential for the necessary high-quality manufacture required, you cannot simply deliver a few samples: you need to manufacture the precision tools. The conditions required for consortia to apply for funding are to reach this demonstration-level objective, which usually requires the building of plant and machinery. Such 'pilot line' projects must go beyond a conventional research and development strategy to a genuine manufacturing line capable of demonstration. That is what defines such a 'pilot line' project.

#### At what stage are your projects now?

Things have moved apace since the KET report in June 2011. Member States had exhausted their budgets— so the first calls were done in early 2012. We called for expressions of interest and received 16 with a total funding request of €1.8 billion. With €720 million included in the first pilot line scheme, of a total €845 million available to ENIAC, this represented a third year consecutively in which we have doubled the amount of funding committed to projects.

#### What more can be done to secure these aims?

I believe that what we have created serves as a pioneer scheme and that if it is institutionalised within the Horizon 2020 programme will assist in fulfilling the objectives of the Commission. According to Commissioner Kroes, there is no reason why Europe should not have 20% of the market in nano, where it currently holds only 8%. There are two elements of capital importance. The first is to make a jump in the funding of nanotechnology within the Horizon 2020 framework programme, and secondly to enable funding to be combined using different funding streams. For example there must be synergies that can be tapped into within Cohesion funding and excellence research funding; such joint funding flexibility should not be prohibited.

### Multi-KETs activities

Multi-KETs activities are defined as the combination of advanced manufacturing technologies/processes and at least two other KETs in a way that value is created above and beyond the mere combination of the individual technologies.

Synergies between technologies are both a characteristic and a requirement for a multi-KETs approach. The challenge related to this technological synergy will be of particular relevance at higher Technology Readiness Levels (TRL) where technology building blocks are integrated. In order to maximize the industrial impact of R&D&I activities, it is therefore recommended to dedicate EC support for multi-KETs to industry pilot line activities in the TRL range 5 to 8 as part of a balanced approach to address the entire R&D&I cycle, and to encourage Member States and regions to provide equivalent and complementary programmes and measures.

In order to speed up innovation along value chains and address new market opportunities including those that will be generated by solving societal challenges, Public-Private Partnerships (PPPs) and other initiatives should link and coordinate actions. These activities could include joint calls to invest into pilot lines (including

demonstrators). Such actions should be implemented in areas of common needs and technologies across sectors. The European Commission is requested to establish coordination mechanisms between industry and the relevant EC Services especially to cover cross-cutting issues. The opportunity to launch joint calls should be addressed to meet the value chain concept at the core of KETs policy.

Test cases of industry multi-KETs pilot lines of significant capital investment should be carried out to demonstrate the feasibility of implementing such ambitious pilot lines in Europe, especially within the context of the smart specialisation. These pilot lines should bring together different funding sources and instruments, including industry and private sources, Horizon 2020, regional, and/or national funding, as well as financial sector instruments including new financial instruments. The HLG has identified four such representative test-cases of



high industrial interest in line with the priority areas of the defined new industrial policy<sup>47</sup> to which industry is committed to investing. Their objective is to demonstrate the feasibility of implementing such ambitious pilot lines in Europe.

Considering the maturity of innovative technologies, components and products in these areas, and their relevance to address important societal challenges, industry and public authorities in charge of support programmes are asked to support the implementation of such test cases.

- **Smart structures:** lightweight, high strength, and functional materials and manufacturing processes addressed to the transport, building and other sectors.
- **Embedded energy:** integration of different technologies enabling electric, thermal and chemical (incl. renewable) energy storage for the mobility, construction and manufacturing industries.
- **High-Performance Production:** up scaling/validation of high-performance production technologies with new levels of integration of processes, technologies and/or functional features.
- **Innovative industrial processes** using renewable resources (biomass as well as CO<sub>2</sub>), enabling innovative products and product applications.

## Recommendation 2: Implementing multi-KETs activities

The High Level Group recommends that the European Commission dedicates EC support for multi-KETs to pilot lines (including demonstrators) in the TRL range 5 to 8. The High Level Group identified test cases of multi-KETs pilot lines of high industrial interest and significant capital investment that could be carried out with support of the Commission, Member States and regions. The High Level Group recommends to strengthen coordination and links including joint calls between PPPs and other initiatives of the different pillars of Horizon 2020, to invest into pilot lines.

## Allow combined funding mechanisms

In times where public and private resources are severely constrained, it is all the more important to exploit synergies between different funding sources to allow for their most efficient use. Typical pilot line expenditures in the KETs domain range from 10 million up to one billion euros, including both investments (Capital Expenditure - CAPEX) and operating costs (Operating Expenditure - OPEX). Costs at such levels require the establishment of mechanisms, which allow to cumulate different funding sources, i.e. from public and private actors as well as from different public sources. In particular, with regard to Higher TRL activities (7-8), which are very capital-intensive, the HLG draws attention to the need to allow efficient multi-source funding mechanisms involving European, national and regional and other sources (e.g. EIB) as necessary. The Commission and Member States must ensure that their implementation instruments allow to cumulate different funding sources via combined

47. Communication from the commission to the European Parliament, the council, the European Economic and Social Committee and the Committee of the Regions, *A Stronger European Industry for Growth and Economic Recovery*, Brussels, 10.10.2012, COM(2012) 582 final



mechanisms, in particular for industrial pilot line projects with important capital investment and, for complementarity between R&D&I and other funding financing instruments. In particular:

- Member States and regions should exploit the possibilities offered by Articles 55, 60, 87 of the proposed Common Provisions Regulation of Cohesion Policy to create a working solution for combining funding from European public sources (as H2020, ESIF, COSME, ESF and EIB) and to allow for critical mass and connectivity in KETs across regions;
- In the context of combined funding mechanisms, the Commission under Horizon 2020, as well as national and regional authorities in charge of R&D&I programmes are invited to clarify CAPEX eligibility for financing pilot line and other KETs projects using public funds. The aid should be calculated on the basis of the full acquisition and fittings cost in line with international depreciation rules;
- Solutions for combined funding must respect the required industrial timescale constraints for funding.



**Sabine Herlitschka,**

*Vice President & Chief Technology Officer Infineon Technologies Austria AG*

#### **What is the significance of industrial ecosystems for European competitiveness?**

Competitiveness is strengthened whenever the various actors work together intensively in Innovation Systems. This is particularly true for large and small companies. Together they form company "ecosystems", complementing and fostering each others' strengths. These ecosystems are essential to achieve competitiveness based on interconnected value chains. Collaboration along the supply chain at a European level in KETs will lead to unique products and capabilities able to provide solutions to societal challenges. These company ecosystems are also significant in terms of figures: based on regular studies in Austria, every large company ("leading competence unit") works with 900 SMEs on average.

#### **What role do large companies play in these ecosystems?**

Large companies often take the role of the pacemakers in their field of research/operation. They have the capability to turn research results into technologies and products on the market. They also offer state-of-the-art production environments.

#### **How can this be improved?**

Preserving this role for large companies in Europe needs competitive funding conditions as well as adequate State Aid frameworks. KETs pilot line projects as funded under ENIAC are good examples. The complementary funding for regional projects combining Structural Funds and the Research Frameworks Programmes has been discussed for too many years already, Europe needs pragmatic approaches to gain critical mass.

#### **What role can KET pilot lines play in the reindustrialisation of Europe?**

KETs pilot lines bridge the industrial value chain more thoroughly, from basic research to commercially exploitable products. This strengthens indigenous ecosystems, benefitting SMEs as much as big multinationals, and opening up economies of scale. It helps to bridge the valley of death. The other decisive aspect is that they focus on KETs- know-how and competencies crucial to solve the European challenges. But this stage is typically the most expensive one. Most countries outside Europe support this phase in areas of national interest with highly effective funding schemes. Such procedures are urgently required now to the European industry.

### **Recommendation 3: Implementing effective solutions for combined funding mechanisms**

The High Level Group recommends the Commission, Member States and regions to ensure that their funding instruments provide a workable solution allowing to cumulate different funding sources (H2020, ESIF, COSME, EIB, ESF, etc.) via combined funding mechanisms, in line with the short competitive and industrial timeframe constraints. In particular industrial pilot line projects with significant capital investment, require exploiting the possibilities offered by Articles 55, 60, 87 of the proposed Common Provisions Regulation for Cohesion Policy, in the context of the smart specialisation strategy.



## Adapt EU R&D&I State Aid framework

KETs are by nature capital intensive with rapid innovation cycles, and face intensive global competition. The innovation processes allowing to successfully bridge the gap between scientific knowledge and market are complex and risky. The enabling nature of KETs leads to positive externalities that cannot be captured by private stakeholders. Their strong contribution to the competitiveness of regions has led to focused policies and strategies by competing world regions (notably the US and Asia) based on public support which impacts the global level playing field. It has been demonstrated that these policies and strategies result in market distortion creating competitive disadvantages for EU companies. In this context, public support, notably State Aid and fair rules, are necessary in the EU to level the playing field for European industry in a global context. The HLG considers that the European Commission should adapt the R&D&I State Aid framework to the economic constraints of KETs industries by implementing the following measures.

### *Fast track notification*

The Commission should define a "fast track" notification procedure to simplify and accelerate State Aid approval (3 months) for capital-intensive KETs R&D&I projects.

### *Project of Common European Interest*

The High Level Group has identified the provision in the "Project of Common European Interest" (art. 107, 3. b of the Treaty on the Functioning of the European Union) as a potential solution to facilitate capital-intensive KETs projects with high positive impact on the competitiveness of the European economy and the EU 2020 policy, in line with EU competition rules. Guidelines are required to facilitate the use of Art 107,3. b. They could notably include the following eligibility criteria: the strengthening of the EU industry competitiveness vis-à-vis the rest of the world, and the leverage effects beyond the companies and countries involved. The compatibility criteria should be adapted to and weighted according to the specific case of European Project of Common European Interest.

In addition, the conditions for the practical use of the matching clause for R&D&I aid should be adapted. In particular, the High Level Group recommends rendering it operational and applicable: by broadening the scope to cover all types of aid, by allowing matching the intensity of the whole aid package given by other regions and by making it anonymous.

In many third countries, bilateral negotiations between the companies and the country result in high State Aid intensity beyond the support measures officially announced. Bilateral and multilateral trade negotiations should be used by the EU and Member States to address the transparency of State Aids notably in emerging countries.

## **Recommendation 4: Ensuring a global level playing field for KETs R&D&I and investment activities**

The High Level Group, in the context of the ongoing modernization process for State Aids, recommends that for KETs-related projects the European Commission accelerates the notification procedure, proactively facilitates that relevant KETs-related projects qualify as Project of Common European Interest, and renders the matching clause under R&D&I Framework operational. The High Level Group recommends that bilateral and multilateral trade negotiations should be used by the EU and Member States to address the transparency of third countries' State Aids.



### **Ulrike Rabmer-Koller,**

*Vice-President of the Crafts and Trade Division of the Austrian Chamber of Commerce (WKÖ), Chairman, the European Association of Craft, Small and Medium Sized Enterprises (UEAPME) Sustainable Development Committee*

#### **What role do SMEs play in KETs?**

I think that the KETs offer a vast potential and this depends on the balance of small and large players participating in research and development. SMEs are particularly important on the research side – and especially in enabling spin-off enterprises from universities and research institutes – but also all along the supply chain. Many SMEs are highly specialised: there are 5,000 European companies specialised in nanotechnology. But SMEs play a key role across all the KET technologies and across all European regions.

#### **Can KETs encourage SMEs' competitiveness?**

The biggest problem is that KETs-based products are extremely capital-intensive, so research and development require expensive front-loaded costs. High technology pilot lines are necessary to demonstrate that products are reliably capable of being up-scaled. In a general economic environment in which access to venture capital and finance has become very difficult, this makes the task of gaining support for pilot lines all the more important. Co-operation is a key factor for SMEs because they need to join their capabilities with larger companies to create alliances that can play to their strengths, their technological expertise, and to add value to the supply chain. SMEs should look for alliances with research institutes, universities, and companies. Sometimes the public does not realise that something manufactured by or associated with a very large company, actually originated as the idea of an SME. It is often much easier for the larger companies to bring products to the market. Similarly, collaboration with larger companies assists with expensive and labour intensive intellectual property issues, such as registering patents, something that SMEs find difficult to do. Relating the importance of SMEs within the KETs supply chain, we should also bear in mind the broader role that they play in the economy, and the need to foster and encourage this. SMEs represent 99.8% of all European companies, and for them to play a valuable role in KETs their day-to-day business must also be made manageable, with the regulatory burden – often designed with larger companies in mind – kept to the minimum.

### **Strengthening SMEs innovation capacity through access to early stage prototyping facilities**

More than one third of all new jobs globally come from small, high-growth firms. SMEs are strategic for the European economy in creating jobs and advancing innovation and need to be better supported and accompanied in their innovation activities. In particular, they experience significant difficulties in overcoming the KETs "valley of death" and delivering early stage prototypes to end-user clients. Most European SMEs cannot afford the expensive capital investment required for pilot line (including demonstrator) investments, and cannot gain access to industrial-scale prototyping facilities (e.g. contract manufacturing), due to the small volumes they need. Many research and development organizations provide access to their technology platforms but the number and scope of KETs technology platforms should be increased to further trigger technological innovation. Collaboration between small and big companies is key to ensure value-chain synergy, access to customers for SMEs, and deployment of KETs in Europe. To

remedy this situation, the High Level Group recommends the launch of an SME KETs initiative through which:

- The European research and development organizations will offer to innovative companies, in particular SMEs, a set of technological platforms broadly covering the domains where KETs can trigger innovation in products;
- The European Commission supports specific actions to promote a strengthened cooperation between research and development organizations for the benefit of SMEs;
- Specific measures are implemented to facilitate access for innovative SMEs to European technological platforms to move from research activities to prototyping development and to provide access to appropriate early stage prototyping and test platforms;
- Considering that SMEs, due to constraints associated with their company size, have difficulties to access specific innovation activities, the HLG recommends that the Commission ensure that support to technological research infrastructures in European research and development organizations and industry, will include a facilitated access for SMEs to support R&D&I activities including, risk analysis and technology building blocks development and, supports market studies, benchmarking as well as the management, protection of intellectual assets for SMEs.

- Mid-sized companies play a key role in the future implementation of KETs-based products and processes. These mid-sized companies are a very dynamic and fast-growing market segment and an important provider of new technologies in the area of KETs. The HLG welcomes the EIB's recently adopted Growth Financing Initiative (GFI) that, for the first time, offers mezzanine financing at a larger scale to innovative mid-cap companies in Europe.

#### **Recommendation 5: Reinforcing the KETs innovation capacity of SMEs and small & mid-caps**

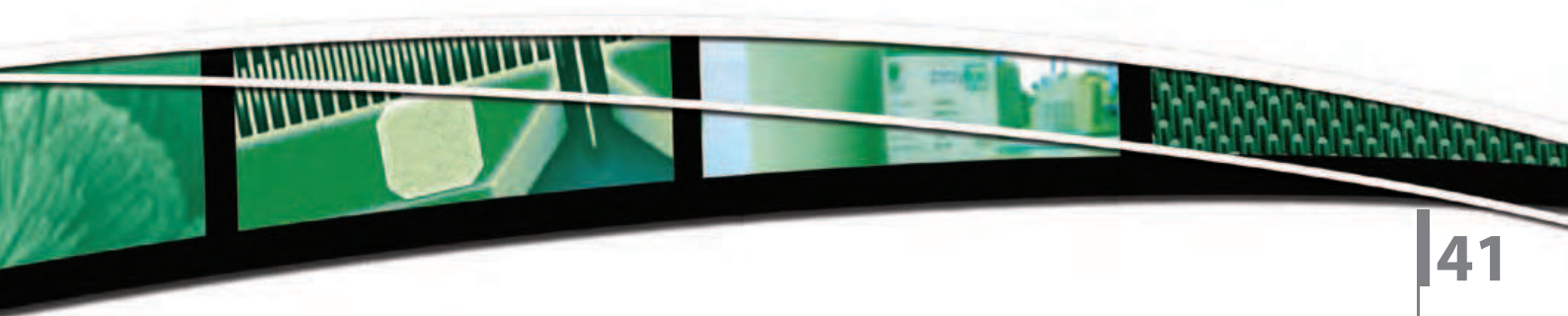
Considering the vital role of SMEs and small & mid-cap companies in job creation and innovation in the European Union, and their difficulties to install or have access to pilot line or early stage prototyping facilities, due to limited resources, business size and financial capacities, the High Level Group recommends the European Commission to proactively support specific actions to promote and enable pan European access to a set of KET technology platforms to accelerate the entry to the market of early stage KET based prototypes enabled by SMEs in alignment with European supply chain.

#### **Anchoring a competitive global manufacturing and industrial landscape in Europe**

It is essential to create and maintain in Europe attractive economic environments regions based on strong industrial ecosystems in EU regions. Globally competitive manufacturing facilities link many SMEs, acting as sub-contractors and suppliers to downstream industry users to global value chains. These facilities that must produce large volumes to achieve economies of scale are very important for a sustainable industrial base in the region and in Europe. It is crucial to nourish and to continue developing such European industrial ecosystems comprising large and small companies. Only manufacturing facilities of a certain size can provide the means to integrate technologies and product development, to react to international competition, and to drive the rapid renewal and innovation cycles in the field of KETs based products. The High Level Group therefore suggests that the appropriate political, financial and regulatory environment is put in place. In particular, recognising the significant lending efforts of the EIB to date, the EIB is called upon to further strengthen its role as a catalyst to attract more private sector financing in both debt and equity. The Commission and the EIB should continue to exploit the possibilities of their Memorandum of Understanding (MEMO/13/150) as well as the EIB capital increase of €10 billion. The High Level Group recommends the EIB to develop sources, concepts and methods of funding of KETs related projects that match the needs of capital suppliers and users to encourage investment in KETs projects.

#### **Recommendation 6: Anchoring globally competitive manufacturing in Europe**

The High Level Group recommends that the European Commission puts in place the appropriate political, financial and regulatory environment which will allow the European Union to both attract and maintain globally competitive manufacturing activities in Europe. The EIB should continue to exploit the possibilities of the Memorandum of Understanding signed with the European Commission, as well as of the increased funding volume for KETs related projects, resulting from the EIB capital increase of €10 billion.





### 3.2 KETs ENABLERS TO SUPPORT EUROPEAN COMPETITIVENESS AND JOBS: FOUR PRIORITY ACTIONS

In parallel to the actions underpinning the reindustrialisation of Europe through innovation, the High Level Group reiterates the need for an integrated and holistic approach to KETs. Key ingredients include:

- To develop KETs human capital and skills;
- To protect and exploit European public funded intellectual assets;
- To leverage societal challenges in order to stimulate European KETs market and supply;
- To promote KETs policies at national and regional level.

#### Developing KETs human capital and skills

New technologies cannot be developed and brought to the market if the European work-force does not possess the necessary skills. The High Level Group suggests that the European Commission promote KETs education and training activities as follows:

- Establish a KETs Strategic Education & Training (E&T) plan. The objective is to identify multidisciplinary competences in KETs related subjects, to design new curricula able to manage KETs innovation, and to mobilize educational systems and training institutes to provide such curricula. In parallel, PhD and master degree courses together with complementary certified working and training activities should be developed with EU KETs & Multi-KETs technological research facilities and pilot lines.
- Following the decision of the Council<sup>48</sup> to propose a KIC on Added-Value Manufacturing particularly addressing the combination of



**Josep Planell,**  
*Rector of Universitat Oberta de Catalunya*

#### Where is the key skills gap in European education that will need to be bridged in applying successful KETs programmes?

The gap is between the kind of specialisations needed post-bachelor degree by universities, so at masters-level. There is a need at this level to have more interdisciplinary academic research across all the KETs, because in most cases what is required is a combination of skills across sectors. The biggest current gap is not in the academic training but in the corporate application of the academic research required for the pilot lines. This need to convert the research to the market requires more technological, hands-on skills that will require more collaboration between academics and the private sector.

#### What are some of the challenges that will be faced in achieving that?

Companies will need to lead the way, in the sense that they know what they need to get to market; they need to state the technological demands. Industrial doctorate initiatives, enabling researchers to spend more time within enterprises need to be enhanced. Innovation can be fostered by creating the right stimuli, so rewards need to be both academic but also financial. This also needs to take place within a broader ecosystem that plays to the strengths of this sort of industrial research: companies need to have good IP protection and proper patent agents in place, and public-private partnerships should also be encouraged.

#### Is Europe ready to change its somewhat hidebound academic culture to provide for these changes?

Academic and industrial ecosystems differ throughout the world. For example in the US it would be far more common for academics to aspire to set up their own companies post-doctorate, and that is less common in Europe. By building more competition into the research system that can change. The structure of the academic world does not always help in Europe, and more reform will be needed. So structural changes should come, but once these are in place a change in mindset will follow.

48. Partial general approach (December 2012) on the Proposal for a Regulation of the European Parliament and the Council establishing Horizon 2020 - The Framework Programme for Research and Innovation (2014-2020)



multiple Key Enabling Technologies, within the European Institute of Innovation and Technology (EIT), the HLG recommends that an agreement be achieved between EU decision makers, to accelerate the launch of a new KIC on Advanced KETs enabled Manufacturing in 2014, rather than 2017, in order to contribute to achieving the target of 20% of GDP coming from industry by 2020 and respond to the urgent need to boost the manufacturing sector in Europe.

- Considering the key role of the European Social Fund (ESF) in supporting Member States actions in various strategic domains related to employment and job opportunities, the ESF should explicitly address the KETs skills deficit in line with the new EU industrial policy and KETs strategic education and training plan. Within its scope of assistance, particular attention should be paid to the need to increase the adaptability of KETs workers, enterprises and entrepreneurs with a view to improving the anticipation and positive management of economic change.
- It is important to ensure that enabling technological research in KETs are appropriately addressed in the Excellence Science Pillar of Horizon 2020, given their key role to stimulate innovation. In particular, the ERC should identify appropriate ways of increasing its role in promoting individual excellence in technological research and innovation. To reflect this ambition, an appropriate target would be 15% of the ERC budget dedicated to KETs related technological excellence. In addition, the Commission through its FET programme, should amplify its actions on multi-KETs related activities, in particular by promoting interdisciplinary collaborations towards solid foundations for future and emerging KETs and multi-KETs (example: high performance computing, adaptive materials, ecological technologies).

### **Recommendation 7: Accelerate development of KETs human capital and skills to stimulate long term innovation**

The High Level Group recommends that the European Commission, Member States and regions, address the current KET skills deficit in a comprehensive and integrated manner across all technical levels and in the different KETs domains. A Europe wide education and training plan should be put in place. The weak support of individual excellence in KETs related technological research should be addressed by increasing up to 15% the share of ERC budget dedicated on this thematic. A KIC on Advanced KETs-enabled Manufacturing should be launched in 2014. The European Social Fund should be mobilized to improve KETs employment and job opportunities in European regions, in particular amongst Europe's young talent pool. Finally, it should ensure a pool of skilled technologists on strategic multi-KETs fields through its Future and Emerging Technologies Programme (FET).

### **Protecting and exploiting European public funded Intellectual assets**

In view of the new scope of European research and innovation programmes which will also support activities closer to the market (for example prototyping, piloting and demonstrating), it is important to pay more attention to the protection and exploitation of results from these EU funded activities. More particularly, in times where



**Heinrich Daembkes,**

*Vice-President of EADS Engineering, Germany, President of Artemis Industry Association Steering Board*

#### What does a strategic KETs components supply mean for Europe?

During the early 1990s we were manufacturing radars for earth observation satellites. At that time we did not have the technology to create the necessary frequency amplifiers we needed, since only US suppliers had them. Very close to the end of the manufacturing run, the US authorities revoked the export license for the amplifiers and demanded we deliver them back. The difficulty was that European technology depended on US supplies in a situation where other possible suppliers – the Japanese – were not exporting at all. Consequently, France and Germany decided to create the technology for themselves through the establishment of United Monolithic Semiconductors, a joint venture between Thales and EADS, now itself now exporting to the US. Another example can be seen in military or civil applications with our developed unmanned air systems. One of the key challenges lies in the 'data links' used to control the drone. These can be ground-to-air 'line-of-sight' controls. A line-of-sight control requires high frequency silicon chips not produced in Europe. When we tried to purchase them from the US there was immediate export restrictions. Although these latter were imposed to safeguard the military technology, these have become tools in global economic competition. There was a time when there were several Airbuses to be delivered, that relying on navigation systems which in turn relied on data systems provided from the US. They refused the export licences at the last minute. Although there was no official justification of this action as being connected to a trade dispute, the action clearly had an impact on Airbus trade at a time when it was in dispute with Boeing.

#### How do you believe KETs can play a role in overcoming this challenge, and what problems remain in achieving this goal?

All these examples show that where there is a monopoly, this tends to immediately create conflicts and distortions of competition, so alternative sources of production are always important. In certain cases where the goods have a sensitive or security application and where short response times are needed for production, it is critical that Europe retains the technological KETs independence to prevent it from trade blackmail by any other parts of the world, whether Asian or US.

public money is scarce, EC project results should have a clear return on investment for the European economy to commit tax payers' money in line with the European growth and jobs agenda.

- The European Commission should develop and include provisions in grant agreements for projects closer to the market that clearly require an exploitation plan for innovation. This exploitation plan should clearly demonstrate how the exploitation of project results will directly contribute to the European economy;
- Intellectual assets resulting from EU funded projects should be adequately protected for European benefit. In the case of technological transfer, first exploitation (under reasonable circumstances) of IP arising from European public funded R&D&I should be made in Europe;
- IPR should receive specific attention in bilateral trade agreements in a spirit of reciprocity.

### Recommendation 8: Protect and exploit European funded intellectual assets

The High Level Group recommends that the European Commission develops and includes provisions in grant agreements for European innovation projects closer to the market, requiring an exploitation plan demonstrating a clear return on investment for the European economy. In the case of technological transfer, first exploitation (under reasonable circumstances) of IP arising from European public funded R&D&I should be made in Europe. The High Level Group also recommends the European Commission to ensure that technology transfer of European Commission public funded Intellectual assets receives specific attention in bilateral trade agreements in a spirit of reciprocity.



## Accelerate innovation and contribute to EU Industrial Policy by leveraging societal challenges to stimulate European KETs market and supply

The most urgent target of the EU2020 Strategy is to create sustainable growth and jobs in Europe. Growth and jobs will depend on simultaneous activation along industrial value chains. Therefore, when addressing and discussing measures to tackle Societal Challenges, a wide range of stakeholders are needed, and in particular those industrial sectors having potential for job creation along European value chains. This is key to reach the targets of the EC Industrial policy to create 20% of GDP from industry.

An innovation dynamic can only be created if policies and projects on Societal Challenges include both dedicated demand side and supply side innovation measures, along strong value chains in Europe, meeting sustainability criteria (use societal challenges push-and-pull). Demand side measures can help to deploy KETs. Public procurement or demand-driven initiatives can indeed provide a route to the market.

Societal Challenges are defined by very complex layers of stakeholders interests from EU to local and individual levels. Europe must balance this complexity of Societal Challenges with the need for simplification to ensure the broad, affordable availability of innovative industrial solutions from KETs across Europe. Therefore, reliable, transparent and structured public decision processes and inclusive governance for the various societal challenges within the EU programmes are a prerequisite to unleash the growth and jobs potential within the industrial value chains. This will encourage long term engagement and investment in KETs in Europe.

Clear decision processes with mandate and accountability are needed. New formal and practical interlinks should be established between the Horizon 2020 programme framing of Societal Challenges and Industrial Technology Leadership along KETs value chains.

The formal interlinks have to ensure wide representation of KET stakeholders in EU advisory groups for implementation of the societal challenges programme e.g. in Horizon 2020 and by taking full account of relevant aspects of research and innovation agendas and roadmaps of European Technology Platforms (ETPs), Public-Private Partnerships (PPPs) and European Innovation Partnerships (EIPs).

The European Commission and policy makers at European, national and regional level, are requested to take measures to fully exploit the technological potential to reach EU policy objectives in the area of societal challenges, solutions to European societal challenges should use European KETs technology building blocks. The European Commission is requested to launch KETs related value chain test projects in areas like resource efficiency, mobility, energy, demonstrating the leverage of societal challenges to stimulate European KETs market and supply.

### Recommendation 9: Leverage societal challenges to stimulate European KETs market and supply

Solutions to European societal challenges should use European KETs technology building blocks. The High Level Group recommends the Commission to ensure strong engagement of KETs industries/ value chains in implementation and in relevant advisory groups dealing with societal challenges programmes. Benefit-risk approaches based on dedicated applications/uses of technologies must be integral element in the Societal Challenges programme to bridge the public request for innovative and at the same time safe processes and products.

## Promotion of KETs policies at national and regional level

KETs related actions are currently fragmented amongst various actors (EU, national and regional authorities). Therefore, it is essential to create synergies between EU policies and instruments and ensure coordination of EU and national activities. The High Level Group highlights the need for Member States and regions to make best use of smart specialisation strategies and the instruments at hand to support the re-industrialisation of Europe and welcomes Member States and regions efforts to seek complementarity with European instruments.

### Recommendation 10: Promote KETs policies at national and regional level

The High Level Group recommends that the European Commission makes full use of smart specialisation to promote KETs in EU Member States and regions and to monitor the uptake of KETs in connection with their research and innovation strategies. In this context, the European Commission is invited to prepare an annual report mapping the regional and national development and deployment of KETs, including across the full TRL scale. The Member States and Regions are asked to provide relevant data to facilitate this task.

The High Level Group also recommends Managing Authorities in charge of operational programmes to fully exploit the opportunities offered by KETs in the policy mixes implemented to attain the objectives set out in their smart specialisation strategies, including via an entrepreneurial discovery process involving also industrial ecosystems.





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## APPENDICES

## 1. EUROPEAN COMMISSION MANDATE, TERMS OF REFERENCE, TASKS AND WORKING METHODS FOR THE HIGH-LEVEL EXPERT GROUP ON KEY ENABLING TECHNOLOGIES (HLG KET)

### General remarks on the High Level Group

Following the recommendations of the first High Level Group on Key Enabling Technologies (KETs) launched in July 2010 with a mandate of one year, the Commission elaborated a single and comprehensive strategy on KETs to promote their deployment in Europe. This has been adopted by the Commission on the 26th of June 2012. To forge the implementation of the European Strategy for KETs and as foreseen in the Communication of June 2012, an external KETs Issues Group, namely the KETs High Level Group, is set up to advise the European Commission and to monitor progress in the development and deployment of KETs for a competitive Europe. The High Level Group will allow the Commission to consult the main stakeholders on a regular basis in order to constantly interact and receive feedback on the development and implementation of the EU KETs policy.

The aim of the High Level Group is:

- To discuss and advise the Commission on any KETs-related policy issues;
- To follow up the implementation of the European Strategy for Key Enabling Technologies adopted by the Commission on the 26<sup>th</sup> of June 2012;
- To promote the development of KETs policies by the Member States.

The HLG is expected to deliver solid results. The members are appointed by the Commission from key actors along the whole KETs value chain. The following stakeholders are represented: (1) technology representatives for each of the six KETs (micro-/nanoelectronics, industrial biotechnology, photonics, nanotechnologies, advanced materials, advanced manufacturing) and for multi-KETs (as most innovative products are a combination of different KETs); (2) down-stream industry users as the aim of the KETs Strategy is to boost the production of KETs-based products; (3) cross-cutting KETs representatives and civil society representatives: the European Investment Bank, the Research Community, the Skills and SME Community as well as other relevant stakeholders from civil society (trade union association, environmental NGO, Covenant of Mayors; and (4) the relevant Public-Private-Partnerships (PPPs) in order to ensure coherence and create synergies. In doing so, the European Commission sought to achieve a balanced overall composition, based on broad representation and expertise of the members while keeping the size of the HLG to a manageable level.

The HLG will ensure that the positions of all the different stakeholders are duly taken into account and work towards a consensus around a supportive environment for KETs.

The High Level Group is an expert group within the meaning of the Communication from the President to the Commission [C(2010) 7649 final]. The Chair (President) of the High Level Group is appointed by the Commission services. Commission officials with an interest in the proceedings may attend the meetings of the Group or the sub-groups. Experts or observers with specific competence on a subject on the agenda may be invited to participate in the Group's or its sub-group's deliberations.

The names of the member organisations are published in the Register of Commission expert groups, as well as the names of the individuals representing their organisation in the High Level Group and the Sherpa Group.



## Tasks of the High Level Group

The KET High Level Group will give advice to the Commission on the implementation of European Strategy for KETs, as outlined in the Communication of June 2012. The group will assist the Commission in enabling discussion with Member States/regions and private stakeholders on the implementation of that strategy. Areas covered by the communication include

- The financial engineering of KETs projects;
- The synergy between EU instruments and between different KETs;
- The mobilisation of trade instruments to ensure fair competition and a level international playing field for KETs;
- State aid related issues in view of the existing state-aid framework and ongoing reviews;
- The identification of potential projects of common European interest;
- The identification of regulatory impediments to the commercialisation and market uptake of KETs and the free circulation (internal market) of KETs based products;
- The integration of KETs development with member state economies to allow Member States/regions to leverage the particular strength of their local economy;
- The commitment of private stakeholders in support of the EU KETs policy;
- The supply of skilled labour in KETs related areas;
- The follow-up of the market evolution and policy measures with regard to KETs, in the EU and abroad.

## Working methods and structures

### *The High Level Group*

The HLG will hold its meetings in Brussels. The meetings will be opened by the European Commissioner responsible for Enterprise & Industry in cooperation with the Commissioners in charge of the Digital Agenda, Research & Innovation and Regional Policy. Other Commissioners will be invited to participate to the debate according to the agenda.

At least up to three meetings are anticipated – kick-off, mid-term and final.

The HLG will deliver a mid-term report one year after its first meeting. A final report will be delivered to the Commission by the end of 2014.

The detailed working arrangements and the creation of ad hoc sub-groups will be prepared by a Sherpa Group and decided by the HLG itself. The Commission staff will provide the secretariat and logistical support as appropriate.

### *The Sherpa Group*

Each member of the HLG will nominate a personal representative to the Sherpa Group.

Representatives are expected to be of a high level, able to represent their organisation. Acting under the HLG's strategic direction and the overall coordination of its own Chairman, the Sherpa Group will focus on the effective preparation of the tasks of the High Level Group.

This includes agreeing on the operational mandate of the HLG, drawing up a Work Programme and ensuring the

set-up and the proper functioning of the working groups.

The Sherpa Group will meet as frequently as necessary. Participation will be reserved to one Sherpa nominated by its organisation. Only in exceptional cases, the Sherpa can be represented by another member of its organisation; prior approval by the Chair will be requested.

### *The Working Groups*

Working groups could be set-up on specific themes in support to the Sherpa Group activities. They will be composed of members of the Sherpa Group. According to the content of each thematic group, experts will be invited to participate to the working group discussions.

The working groups will launch consultations of the relevant European stakeholders through for example the organization of workshops.

Taking into account the importance of Member States in the implementation of the European KETs Strategy, a Member States Group on Key Enabling Technologies will be set up. It is foreseen to hold joint meetings with the Sherpa Group of the KETs High Level Group. The aim of these joint meetings is to allow for exchange of views between the Member States and the members of this group.

### **The scope of work of the High Level Group**

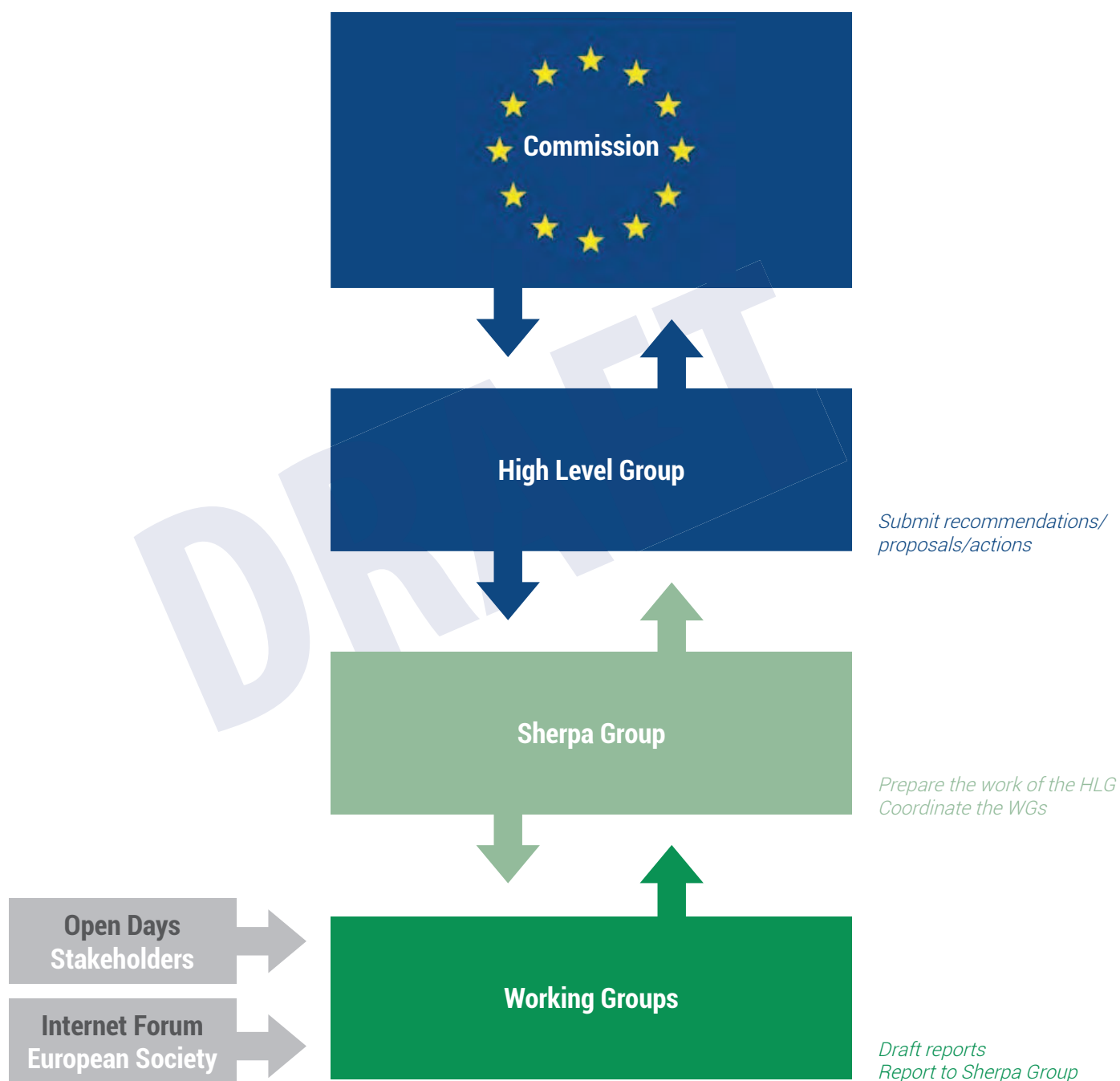
The HLG is expected to provide advice, proposals and policy recommendations on the conditions for further industrial deployment of KETs in the EU (recommendations for short term implementation as well as recommendations of a more long term nature, for new activities as well as reinforcing existing initiatives) and to undertake concrete actions and trigger concrete actions by private stakeholders for further enabling the wide deployment of KETs in Europe.

The Commission is interested in proposals and recommendations for Commission, Member States and the private sector as well as in a full-range of enabling and concrete actions related to the implementation of the European Strategy for KETs as outlined in the Communication of June 2012.

It is expected that the HLG contributes to the successful implementation of the European Strategy for KETs, notably by triggering necessary actions to support its implementation.



## Organisational structure of the HLG



## 2. MEMBERSHIP OF THE HLG KET

### President

Mr Jean THERME (CEA Tech CEO, Executive VP of Renewable Energies - CEA, Member of the Academy of Technologies)

### Members

Prof Luigi AMBROSIO (President, European Society for Biomaterials)

Mr Markus ASCH (Vice-Chairman, Alfred Kärcher GmbH & Co. KG, President EUnited, Representative Sustainable Process Industry PPP)

Dr André-Jacques AUBERTON-HERVE (Chairman & CEO, Soitec, Vice-Chairman SEMI)

Ms Catia BASTIOLI (CEO, Novamont)

Mr David BALDOCK (Executive Director, Institute for European Environmental Policy (IEEP))

Dr Jean J. BOTTI (CTO & Member of the Executive Committee, EADS)

Mr Carlo BOZOTTI (President & CEO, STMicroelectronics, Chairman, European Round Table of Industrialists (ERT))

Ms Kristina DELY (Head of Office, Covenant of Mayors)

Dr Javier EGUREN (Representative of CECIMO, European Association of the Machine Tool Industries)

Prof Fabio FAVA (Professor of Industrial & Environmental Biotechnology, , University of Bologna, Chair, European Federation of Biotechnology)

Mr Philippe de FONTAINE VIVE (Vice-President, European Investment Bank)

Mr Emmanuel FOREST (Executive Vice-President, European and Institutional Affairs, Bouygues, Representative Energy Efficient Building PPP)

Mr Klaus HELMRICH (CTO & Member of the Managing Board, Siemens AG)

Dr Dirk HOHEISEL (Member of the Management Board, Robert Bosch GmbH)

Mr Ejner Bech JENSEN (Vice President Research & Development, Novozymes)

Prof Erkki LEPPÄVUORI (President & CEO, VTT)

Dr Massimo MATTUCCI (Senior Corporate VP & COO, Comau Group; Representative Factories of the Future PPP)

Mr Jan MENGELERS (President, TNO)

Mr Marco MENSINK (Deputy Director General, Confederation of European Paper Industries (CEPI); Representative Bio-based industries PPP)

Dr Michael MERTIN (President & CEO, Jenoptik AG)

Dr Drew NELSON (President & CEO, IQE. President, EPIC – European Photonics Industry Consortium)

Prof Reimund NEUGEBAUER (President, Fraunhofer-Gesellschaft)

Prof Wolfgang PLISCHKE (Member of Management Board, Bayer AG; Vice-President of European Chemical Industry Association - CEFIC)



Dr Reinhard PLOSS (CEO, Infineon Technologies AG; Representative ENIAC PPP)

Ms Ulrike RABMER-KOLLER (Policy Vice-President, Chair Sustainable Development Committee, UEAPME)

Mr Stefano RIMONDI (President Assobiomedica)

Ms Bernadette SÉGOL (General Secretary, European Trade Union Confederation)

Mr Eamonn SINNOTT (General Manager, Intel Ireland)

Ms Pascale SOURISSE (Board Chairman, Telecom-Paristech, Senior Executive Vice President International Development - THALES)

Dr Giuseppe TARTAGLIONE (Chairman Corporate Relations Italy, Volkswagen Group)

Prof Tadeusz UHL (President, EC Grupa)

Prof Luc VAN DEN HOVE (President and CEO, IMEC)

Dr Marc VAN SANDE (Executive Vice-President, UMICORE)



### 3. MEMBERSHIP OF THE SHERPA GROUP

#### Chairman

Prof Gabriel CREAN, Chairman Sherpa Group (VP for Technology, Director Europe, CEA TECH, Member of the European Academy of Science and Arts)

#### Members

Mr Frederic BOYER (Officer Energy Cities, Covenant of Mayors)

Dr Patrick BRESSLER (Director, Fraunhofer Gesellschaft Brussels)

Ms Camille BUREL (Manager for Innovation Affairs, Roquette)

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Mr Patrick DUVAUT (Director of Research, Telecom-Paristech)

Dr Andrew FARMER (Director of Research and Head of Industry, Waste and Water Programme, IEEP)

Mr Filip GEERTS (Director General, CECIMO)

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Prof Krzysztof Jan KURZYDŁOWSKI (Director, National Centre for Research and Development)

Mr Rudolf LICHTMANNEGGER (Deputy Head Economic Policy Department, Advisor Research & Innovation Policies, Austrian Federal Economic Chamber)

Mr Carlos LEE (Director General, EPIC – European Photonics Industry Consortium)

Ms Cecilia MAINI (Life Sciences Platform Coordinator, Aster)

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Dr Walter WEIGEL (Siemens Corporate Technology Vice President External Cooperations)

Mr Markus WILKENS (Laser and Optics Research, Photonics21 Secretariat)

### HLG KET Secretariat:

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Mr. Aziz ZENASNI (European Affairs Manager, Technological Research Division)

European Commission, DG Enterprise:

Mr. Michel CATINAT (Head of Unit Key Enabling Technologies and ICT, DG Enterprise)

Mr Michael BERZ (Policy Officer, DG Enterprise)

Ms Heidi MOENS (Policy Officer, DG Enterprise)









