EU R&D&I policy and programmes for micro/nanoelectronics

Michel Hordies
European Commission
Outline

Horizon 2020
Key Enabling Technologies
Opportunities in 2013
ENIAC Joint Undertaking
Towards a strategy for Europe
Impact of R&D on economic recovery
Outline

Horizon 2020
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Horizon 2020

- Commission proposal for a 80 billion euro research and innovation funding programme (2014-2020)
- Part of proposals for next EU budget, complementing Structural Funds, education, etc.
- A core part of Europe 2020, Innovation Union & European Research Area:
  - **Responding to the economic crisis** to invest in future jobs and growth
  - **Addressing peoples’ concerns** about their livelihoods, safety and environment.
  - **Strengthening the EU’s global position** in research, innovation and technology
Horizon 2020 - Three mutually reinforcing priorities

Excellent science  Industrial leadership  Societal challenges
Objectives and structure
Industrial Leadership

1. Leadership in enabling and industrial technologies (LEIT)
   a. Information and Communication Technologies (ICT)
   b. Nanotechnologies
   c. Advanced materials
   d. Biotechnology
   e. Advanced manufacturing and processing
   f. Space

2. Access to risk finance

3. Innovation in Small and Medium-sized Enterprises
LEIT – ICT

Broad lines of the activities

✓ A new generation of components and systems: Engineering of advanced and smart embedded components and systems
✓ Next generation computing: Advanced computing systems and technologies
✓ Future Internet: Infrastructures, technologies and services
✓ Content technologies and information management: ICT for digital content and creativity
✓ Advanced interfaces and robots: Robotics and smart spaces
✓ Micro- and nanoelectronics and photonics: Key enabling technologies related to micro- and nanoelectronics and to photonics.
Innovation in SMEs

✓ **Dedicated SME instrument**
SME-led projects
Targeted at all types of innovative SMEs with ambition to grow and internationalise
Includes all types of innovation (non-technological, service..)
Supported across societal challenges and enabling technologies areas
  – Phase 1: Proof of concept
  – Phase 2: R&D, demonstration, market replication
  – Phase 3: Commercialisation (only support activities, e.g. facilitate access to private capital..)

✓ **Support for research-intensive SMEs**
Promote market-oriented innovation through Art. 185 JP (Eurostars)

✓ **Accompanying measures**
Awareness raising, info and dissemination, training...
Improving framework conditions
Access to risk finance

✓ **Debt instrument**
  Loans to single beneficiaries
  Guarantees to financial intermediaries
  Combinations of loans and guarantees
  Linked to the SME instrument

✓ **Equity instrument**
  Start-up facility
  Growth facility

✓ **Accompanying measures**
  Technical assistance
  Investment readiness schemes
  Schemes to attract private investors
  Encouragement for philanthropic foundations

=> Implementation delegated to the EIB and EIF
## Indicative budget breakdown *(in million €)*

<table>
<thead>
<tr>
<th>I</th>
<th>Excellent science</th>
<th>27.818</th>
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<tbody>
<tr>
<td>II</td>
<td>Industrial leadership</td>
<td>20.280</td>
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<tr>
<td></td>
<td>1. Leadership in enabling &amp; industrial technologies*</td>
<td>15.580</td>
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<td>2. Access to risk finance</td>
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<td>3. Innovation in SME's</td>
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<td>III</td>
<td>Societal challenges</td>
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<td>European Institute of Innovation and Technology (EIT)</td>
<td>1.542</td>
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<td>Non-nuclear direct actions of the Joint Research Centre</td>
<td>2.212</td>
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* Including EUR 8975 million for Information and Communication Technologies (ICT) of which € 1795 million for photonics and micro-and nanoelectronics, € 4293 million for nanotechnologies, advanced materials and advanced manufacturing and processing, € 575 million for biotechnology and € 1737 million for space. As a result, € 6663 million will be available to support Key Enabling Technologies.
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KEY Enabling Technologies
How and which – Key Performance Indicators

- Photonics
- Micro- and nanoelectronics
- Biotechnology
- Advanced materials
- Nanotechnology
- Advanced manufacturing Systems

**Economic Potential**
- GDP contribution
- Employment
- Market Growth
- Systemic relevance

**Value adding enabling Role**
- General Purpose Technology
- Innovation driver
- Productivity driver
- Spill-over effects

**Technology-Intensity**
- R&D-Intensity
- Innovation cycles
- Know-how intensity
- IPR/ Patenting
- High-skill ratio

**Capital Intensity**
- Initial investments
- Capital expenditure/ Production costs
- Amortisation rates
- Investment per employee

**Advanced manufacturing Systems**

http://ec.europa.eu-enterprise-sectors-ict-key_technologies

Observations of the HLG – The ‘Valley of Death’

Source: Preliminary HLG KET Report, Brussels, 09/02/2011
Recommendations by the HLG

- Make KETs a technological priority for Europe
- The EU should apply the TRL scale R&D definition
- Fully exploit the scope of relevant R&D definitions
- Rebalancing of EU RDI funding programmes
- A strategic approach to KETs programmes
- Establish an appropriate set of rules to implement KETs programmes
- Combined funding mechanisms
- KETs state aid provisions
- Globally competitive IP policy in Europe
- Build, strengthen and retain KETs skills
- A European KETs observatory and consultative body
Need to also support the emerging value chain:

**Equipment/Materials ➤ Foundry ➤ Fabless companies**
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ICT WP 2013 – Some information

The Work Programme will define the priorities for calls for proposals that will result in projects to be launched in 2013.

✓ Last WP for FP7
✓ It will ensure a certain degree of continuity in priorities and at the same time serve as a bridge to activities in Horizon 2020.
Challenge 3– Approach

Challenge 3: alternative paths to components and systems
✓ nano/microelectronics
✓ photonics,
✓ the heterogeneous integration of these key enabling technologies and related components and systems,
✓ advanced computing, embedded and control systems at a higher level.

Energy- and cost efficiency as well as recycling/end of life issues are major drivers across the Challenge.
3.1 Nanoelectronics

- Integration of advanced nanoelectronics devices and technologies (16nm and below)
- Advanced nanoelectronics manufacturing processes
- Design, modelling and simulation for advanced nano-electronics technologies
- International Co-operation
3.3 Heterogeneous Integration and take-up of Key Enabling Technologies for Components and Systems

- **Integrating heterogeneous technologies**
  - Miniaturised smart systems
  - Hybrid integration of organic electronics and micro/nano electronics
  - Further development and validation in real settings of micro-nano-bio and bio-photonics systems

- **Technology take-up and innovation support**
  - Assessment experiments in nano-electronics and smart systems
  - Access services
  - A network of innovation multipliers
  - eco-system for smart systems integration
  - deployment of bio-photonics and micro-nano-bio solutions
  - International co-operation
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Expressed in the Vision of the ENIAC Joint Undertaking, a Public-Private Partnership bringing together R&D actors, Member States and the European Union

VISION
The ENIAC Joint Undertaking shall increase and leverage private and public investments in nanoelectronics contributing to strengthening Europe’s future growth, competitiveness and sustainability

http://eniac.europa.eu

Council Regulation (EC) No 72/2008
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<tr>
<th>Chapter #</th>
<th>Chapter</th>
<th>Grand Challenge</th>
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<td>1</td>
<td>AUTOMOTIVE AND TRANSPORT</td>
<td>Intelligent Electric Vehicle</td>
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<td>Safety in traffic</td>
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<td>Co-operative Traffic Management</td>
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<td>COMMUNICATIONS &amp; DIGITAL LIFESTYLES</td>
<td>Internet Multimedia Services</td>
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<td>Evolution to a Digital Lifestyle</td>
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<td>Self-Organizing Network</td>
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<td>Short range convergence</td>
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<td>ENERGY EFFICIENCY</td>
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<td>Energy Distribution and Management - Smart Grid</td>
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<td>Reduction of Energy Consumption</td>
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<td>HEALTH AND THE AGEING SOCIETY</td>
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<td>Heuristic Healthcare</td>
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<td>SAFETY &amp; SECURITY</td>
<td>Consumer and Citizens Security</td>
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<td>Securing the European Challenging Applications</td>
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<td>Enabling Technologies for Trust, Security and Safety</td>
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<td>6</td>
<td>DESIGN TECHNOLOGIES</td>
<td>Managing Complexity</td>
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<td>Managing Diversity</td>
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<td>Design for Reliability and Yield</td>
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<td>SEMICONDUCTOR PROCESS AND INTEGRATION</td>
<td>Know-how on Advanced and Emerging Semiconductor Processes</td>
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<td>Competitiveness through Semiconductor Process Differentiation</td>
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<td>Opportunities in System in Package</td>
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<td>EQUIPMENT, MATERIALS AND MANUFACTURING</td>
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Timeline

From end 2011:
Parliament and Council negotiations on the basis of the Commission proposals

Mid 2012:
Final calls under 7th Framework Programme for Research to bridge gap towards Horizon 2020

1/1/2014:
Horizon 2020 starts; launch of first calls

Ongoing:

By end 2012:
Adoption of legislative acts by Parliament and Council on Horizon 2020
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The other side of "Moore’s Law"

after IHS iSuppli 2011
There is more than Moore

Moore’s Law: Miniaturization

Baseline CMOS: CPU, Memory, Logic

130nm
90nm
65nm
45nm
32nm
22nm

Beyond & Extended CMOS

Analog/RF
Passives
HV Power
Sensors
Actuators
Biochips

Interacting with people and environment
Non-digital content SoC & System-in-Package (SiP)

Combining SoC and SiP: Higher Value Systems

Information Processing
Digital content System-on-Chip (SoC)

Combining SoC and SiP: Higher Value Systems

Interacting with people and environment

Non-digital content SoC & System-in-Package (SiP)

Combining SoC and SiP: Higher Value Systems

Beyond & Extended CMOS
Neelie Kroes – 24 May 2012:

"Imagine if we built a whole electronics ecosystem right here. Building on the leading technology institutes, and our world-class equipment and materials industry. Connecting the electronics industry with the markets that demand their innovations — public and private, research and industry, small and large business. And connecting with those who can train and supply skilled labour.

... Are we prepared to set strategic alliances, build value chains in Europe, set R&D priorities and invest further downstream?"
THANK YOU

michel.hordies@ec.europa.eu

Information Society and Media:
http://ec.europa.eu/information_society

Horizon 2020 on the web:
http://ec.europa.eu/research/horizon2020/index_en.cfm