(Micro & nano-) Electronics in Europe

??? Step by step to a bright future ? ????

Where do we stand:
EU 2020, KET, H2020 (FP 8), JTI,….

Nano-Tec 6/11/2012

Dirk Beernaert
European Commission
DG CONNECT - Adviser for Interdisciplinary and Integrating Activities

Outline

(partial update of presentation Nanotec 1/2011):

EU2020: A new momentum for Nano-electronics in Europe ?!

- What is going-on at the higher policy level in the Commission? - update
- Horizon 2020 - update
- A strategy for electronic components in Europe !?
- Immediate opportunities (next calls)
- To conclude

From 10 year Lisbon Strategy … to EUROPE 2020

- **UPDATE VISION TO POST-CRISIS WORLD**
- **IMPROVE DELIVERY**

EUROPE 2020: A EU strategy for smart, sustainable and inclusive growth

- **Smart Growth:** knowledge and innovation economy
- **Sustainable growth:** greener and competitive economy
- **Inclusive growth:** high employment, knowledge people and social and territorial cohesion

5 EU Targets – translated into national ones

7 Flagship initiatives – EU & national action

COMMUNICATION FROM THE COMMISSION COM(2010) 2020
http://ec.europa.eu/eu2020/pdf/COMPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf

From 10 year Lisbon Strategy … to EUROPE 2020

EUROPE 2020: A EU strategy for smart, sustain… …h

- **Smart Growth:** knowledge and innov…
- **Sustainable growth:** greener and…
- **Inclusive growth:** high employ…

people and social and territorial co…

2 year and a financial and economic crises later, goals and visions even more valid! It is all about growth and jobs!

5 EU Targe… …ial ones

7 Flagship I… …national action

COMMUNICATION FROM T… …MISSION COM(2010) 2020
http://ec.europa.eu/eu2020/pdf/…MPLET%20EN%20BARROSO%20%20%20007%20-%20Europe%202020%20-%20EN%20version.pdf

Europe 2020: 5 EU Headline Targets

(translated in national and regional ones)

By 2020:

- **75 % (now 69) employment rate** (% of population aged 20-64 years)
- **3% (now 1,8) Investment in R&D** (% of EU's GDP)
- "**20/20/20" climate/energy** targets met (incl. 30% emissions reduction if conditions are right)
- < 10% (now 15) **early school leavers** & min. 40% (now 31) hold **tertiary degree**
- 20 million **less people (now 80)** should be **at risk of poverty**

European Commission
Information Society and Media

Europe 2020: 5 EU Headline Targets

(translated in national and regional ones)

By 2020:

- **75 % (now 69) employment rate** (% of population [illegible] 64 years)
- **3% (now 1,8) Investment in R&D** (% of EU[illegible]
- **"20/20/20" climate/energy** target[illegible] (incl. 30% emissions reduction if conditions are right)
- < 10% (now 15) **early sc[illegible]avers** & min. 40% (now 31) hold **tertiary degree**
- 20 million **less people (now 80)** should be **at risk of poverty**

Targets remain valid!

European Commission
Information Society and Media

Political framework: Europe 2020

7 flagships

- Digital Agenda for Europe
- Youth on the move
- Innovation Union
- An industrial policy for the globalisation era
- New skills for jobs
- European Platform against poverty
- Resource efficient Europe

Political framework: Euro

7 flagships

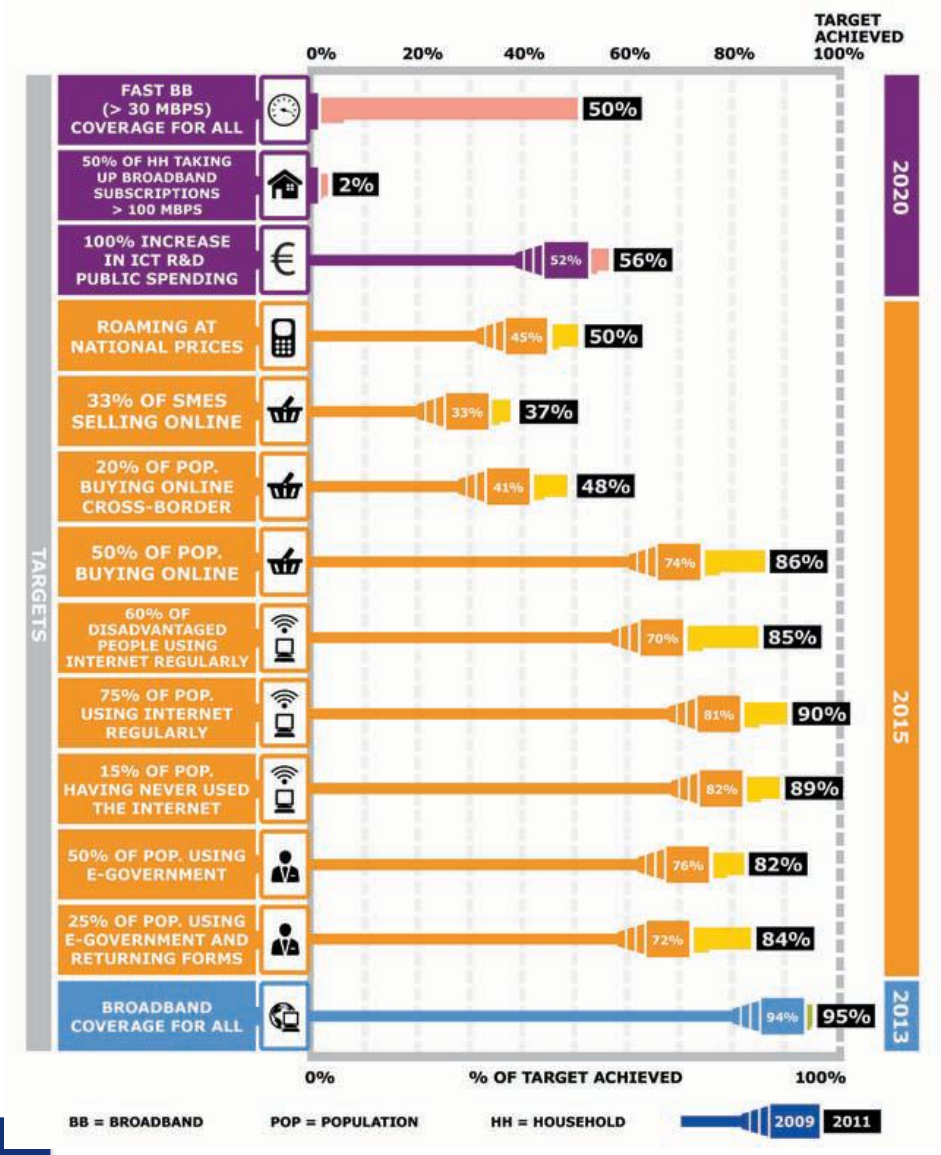
Digital Agenda for Europe

- Youth on the move
- Innovation Union
- An industrial policy … on era
- New skills for …
- European Pla… poverty
- Resource efficient … pe

Flagships have concrete actions (also at MS) and implementation is monitored

Digital Agenda Scoreboard

- Annual state of play of progress in all 101 Digital Agenda actions in all 27 EU Member States
- Overall progress good:
  - 38 actions completed
  - 49 on track
  - 14 actions behind schedule, but delivery dates in 2012
  - Forthcoming DAE Review will provide analysis



R&D&I is part of Industrial Policy

Key Enabling Technologies

Communication COM(2009)512 of 30.9.2009

Micro- and nanoelectronics, including semiconductors

Preparing for our future: Developing a common strategy for key enabling technologies in the EU

Advanced materials

Photonics

Biotechnology

Nanotechnology

Advanced manufacturing Systems

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

European Commission
Information Society and Media

R&D&I is part of Industrial Policy

Key Enabling Technologies

Communication COM(2009)512 of 30.9.2009

Micro- and nanoelectron
including semicondu

Prepa
ol

vanced
materials

Photonics

Biotechnology

Nanotechnology

nced manufacturing Systems

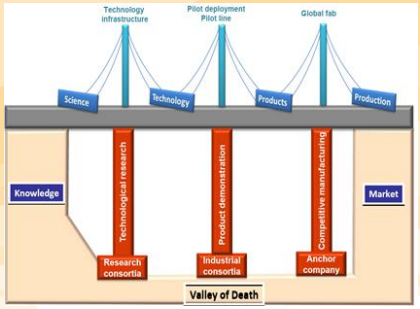
HLG KETs: Key recommendations and answer from Commission

A European strategy for KET – A bridge to growth and jobs

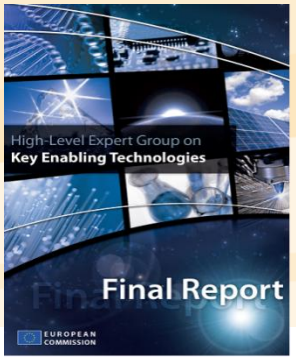
Com (2012) 341

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

European Commission
Information Society and Media



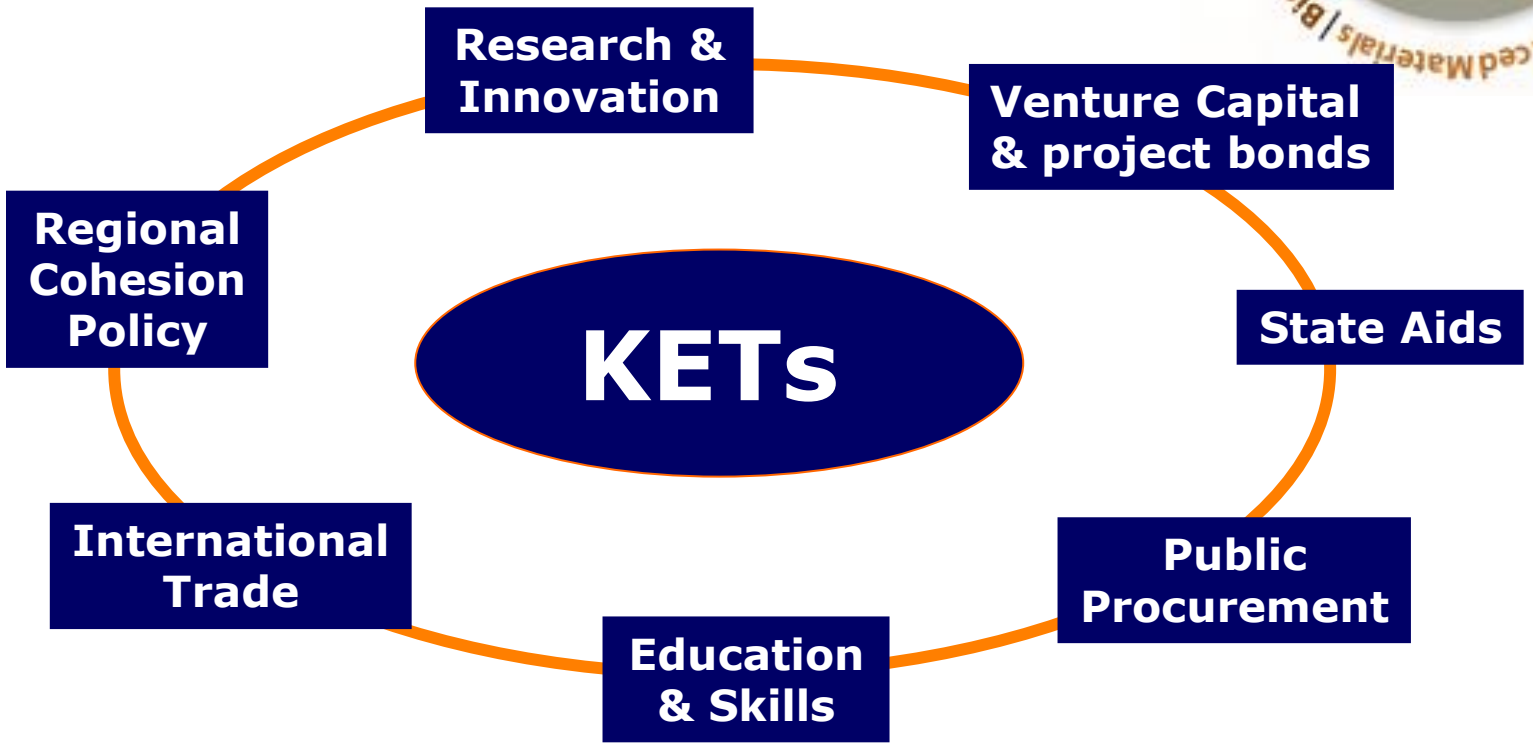
Main Industry Recommendations



Innovation made in Europe

- **Ecosystem,** based on advanced skills & knowledge (involving large and small Cie, institutes, political will, ….)
- **Manufacturing** is important for employment, Europe as global technology provider and access for European customers.
- **Beyond lab-scale** technology demonstrators … towards marketable products! (3-pillar bridge)
- **Improve climate for investments**, rethinking financing R&D and innovation, state aid ,... vis-à-vis the global competition
- **Integrated approach:** R&D&I in all KETs, exploring their combinations and interfaces (X-KET, multi-KET) , addressing whole the value chain

Towards a European (Industrial) Strategy in KETs



What is Horizon 2020?

Draft

Response to the economic crisis to invest in future jobs and growth and competiveness

- **Addressing peoples' concerns** about their livelihoods, safety and environment
- **Strengthening the EU's global position** in research, innovation, technology and manufacturing

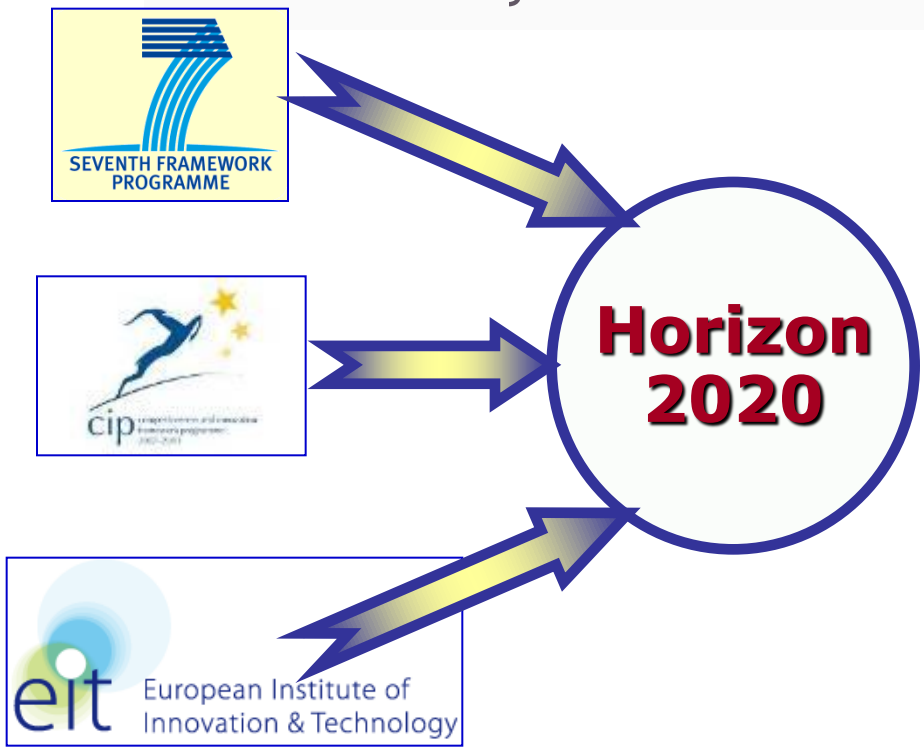
H2020: not business as usual !

- **More innovation:** research + innovation + VC, support high-tech SMEs & non-traditional actors,
- **Focus on societal challenges**, *e.g. health, energy and transport*
- **Simplified access**, *for all companies, universities, institutes in all EU countries and beyond, light, open, fast bottom-up experimentation.*
- **More evidence based and more risk taking**, *participative processes by all, more experimentation*

Horizon 2020

EC proposal: 80 B€

8,5 % of MFF 2014+ (1083 B€ - 1.1% GNI) (and Education and Cohesion Policy: 336 B€ of which large % innovation)



- **Societal challenges**
  Health & Ageing, Energy, Transport, Resource Efficiency, Climate Challenge, ...
- **Industrial Leadership**
  Leadership in Enabling Technologies (ICT, Nanotechnology materials, Biotechnology, Production Technologies, …)
- **Excellent Science**
  ERC, Marie Curie actions, FETs, Research infrastructures

http://ec.europa.eu/research/horizon2020

A Single Program: from ideas to the market

Draft

Priority 1 Excellent science

Why:

- World class science is the foundation of tomorrow's technologies, jobs and wellbeing
- Europe needs to develop, attract and retain research talent
- Researchers need access to the best infrastructures

P1 - Proposed funding (million euro, 2014-2020)

DRAFT

European Research Council Frontier research by the best individual teams	*13 268*
Future and Emerging Technologies Collaborative research to open new fields of innovation	*3 100*
Marie Curie actions Opportunities for training and career development	*5 572*
Research infrastructures (including e- infrastructure) Ensuring access to world-class facilities	*2 478*

FET 3.1 b€

e-Infr 0.9 b€?

Total: 24,4 B€

Priority 2. Industrial leadership

Why:

- Strategic investments in key technologies (e.g. advanced manufacturing, microelectronics) underpin innovation across existing and emerging sectors

- Europe needs to attract more private investment in research and innovation

- Europe needs more industry (innovative SMEs) to create growth and jobs

Industrial Leadership in KETs

Creating Industrial Leadership & Competitive Frameworks in enabling (incl. KET) and industrial technologies

- ICT — 8.975 M€
  - …
  - Micro- and nano-electronics and photonics — 1.795 M€
- Nanotechnologies
- Advanced Materials — 4.293 M€
- Advanced Manufacturing and Processing
- Biotechnology — 575 M€
- Space

~30% to cross-cutting KETs

KETs 6.663 M€

*curent 2014 Prices

Other ICT technologies: **Advanced embedded systems and smart systems; Advanced computing systems and technologies; Future Internet: Infrastructures, technologies and services; Content technologies and creativity; Robotics and smart spaces**

P2 - Proposed funding (million euro, 2014-2020)

DRAFT

Leadership in enabling and industrial technologies (ICT, nanotechnologies, materials, biotechnology, manufacturing, space)	*13 781*
Access to risk finance Leveraging private finance and venture capital for research and innovation	*3 538*
Innovation in SMEs Fostering all forms of innovation in all types of SMEs	*619 complemented by 6 829 (expected 15% of societal challenges + LEIT) and 'Access to risk finance' with strong SME focus*

Total: 17,9 B€

Priority 3. Societal challenges

Why:

- Concerns of citizens and society/EU policy objectives *(climate, environment, energy, transport etc. cannot be achieved without innovation)*
- Breakthrough solutions come from multidisciplinary collaborations, including social sciences & humanities
- Promising solutions need to be tested, demonstrated and scaled up

P3 - Proposed funding (million euro, 2014-2020)

DRAFT

Health, demographic change and wellbeing	*8 033*
Food security, sustainable agriculture, marine and maritime research & the bioeconomy	*4 152*
Inclusive, innovative and secure societies	*3 819*
Climate action, resource efficiency and raw materials	*3 160*
Smart, green and integrated transport	*6 802*
*Secure, clean and efficient energy**	*5 782*

Additional €1 788m for nuclear safety and security from the Euratom Treaty activities (2014-2018). Does not include ITER.

Total: 31.7 B€

Role of the EIT and JRC in Horizon 2020

DRAFT

European Institute Technology (EIT) Combining research, innovation & training in knowledge and Innovation Communities	*1 360+* *1 440**
Joint Research Centre (JRC)** Providing a robust, evidence base for EU policies	*1 962*

Second tranche pro rata from LEIT and Societal challenges (subject to review)

****Additional €656 m for the JRC to be funded from the Euratom Treaty activities***

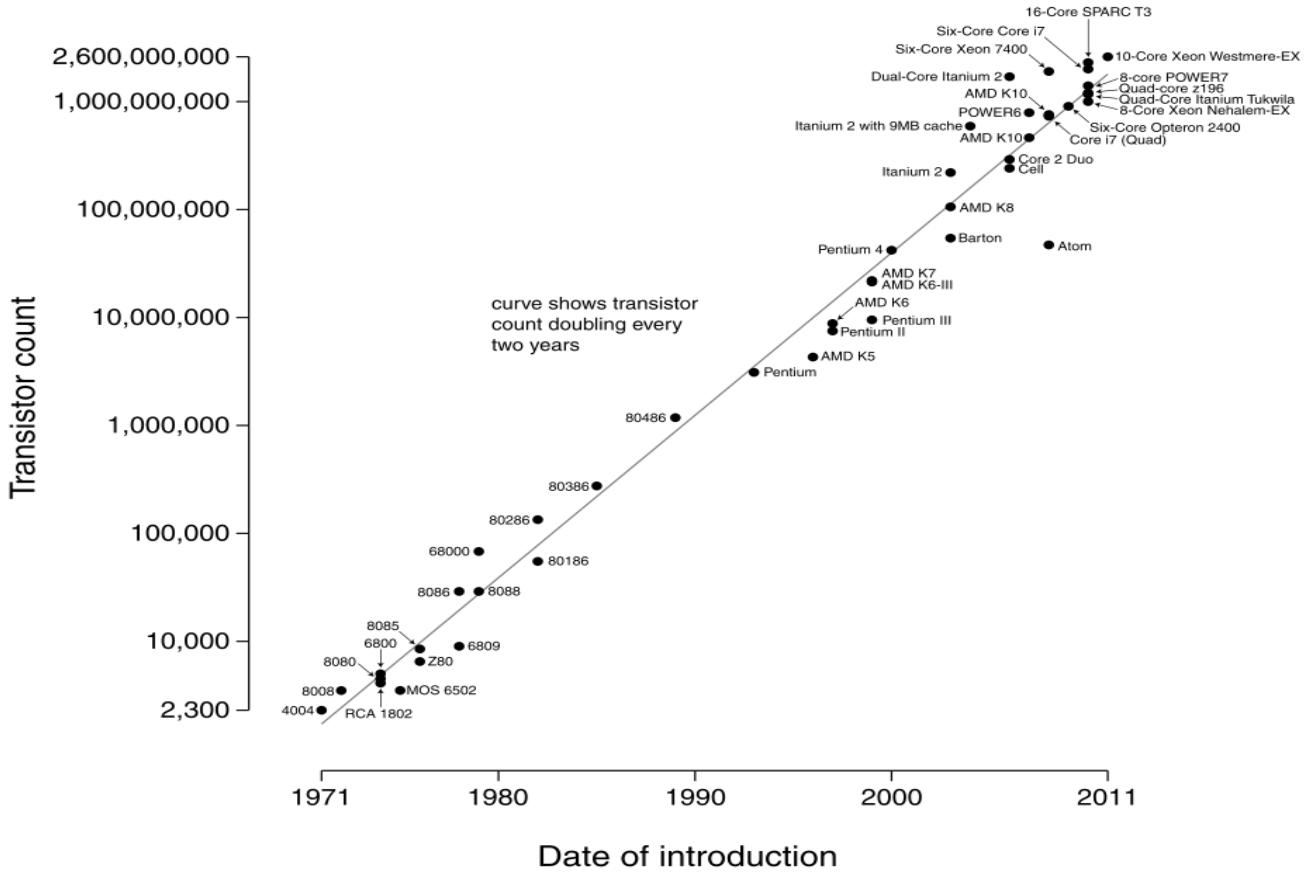
Draft

Next steps

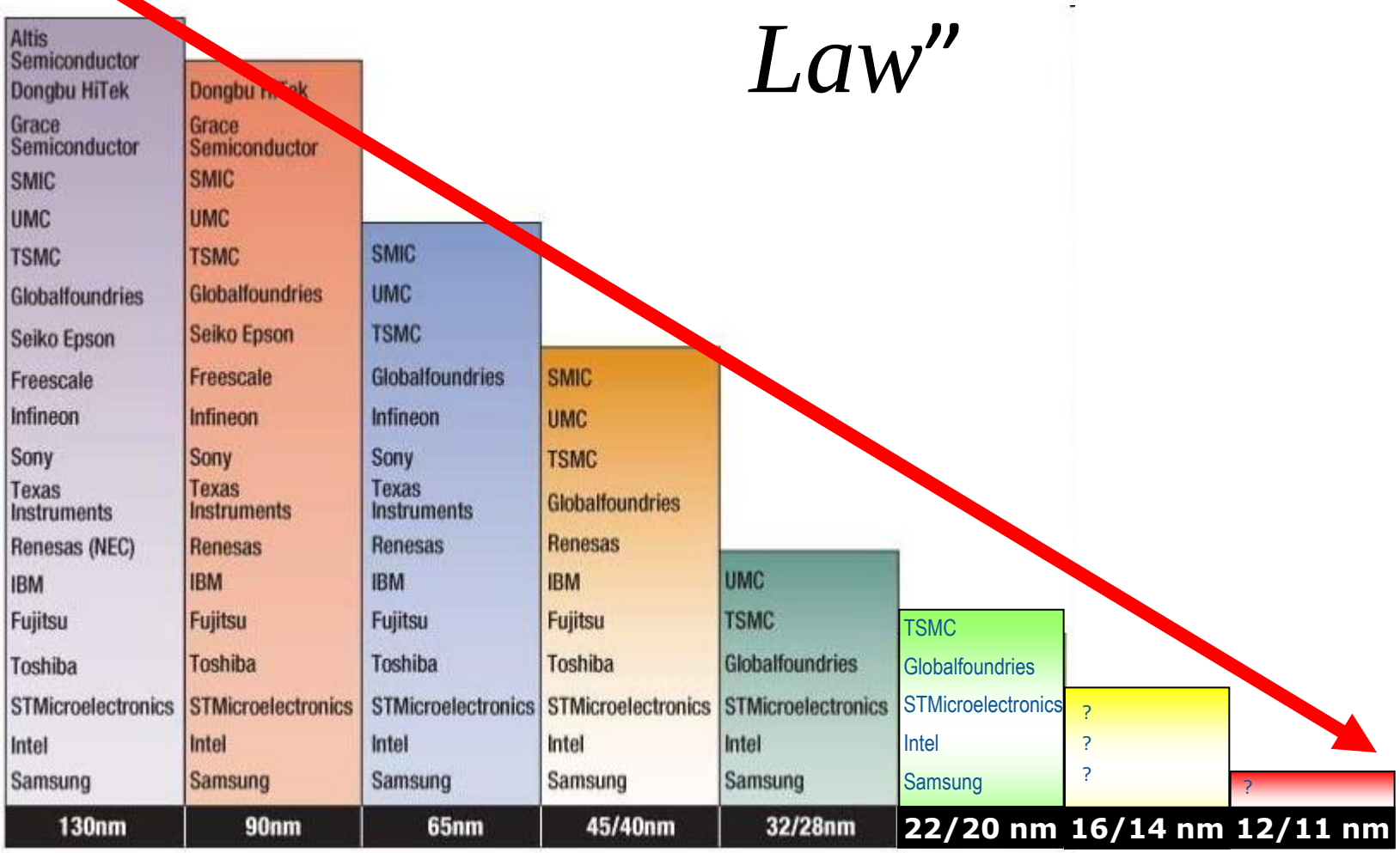
Ongoing:	Parliament and Council negotiations on the basis of the Commission proposals
Ongoing:	Parliament and Council negotiations on EU budget 2014-2020 (including overall budget for Horizon 2020)
Ongoing	Final calls under 7th Framework Programme for research to bridge gap towards Horizon 2020
Mid 2013:	Adoption of legislative acts by Parliament and Council on Horizon 2020
6-8/11 2013:	ICT in H2020 Launch Conference, Vilnius, Lithuania Launch of first calls
1/1/2014:	**Horizon 2020 starts**

A strategy for components in Europe?

Following Moore's law but .....

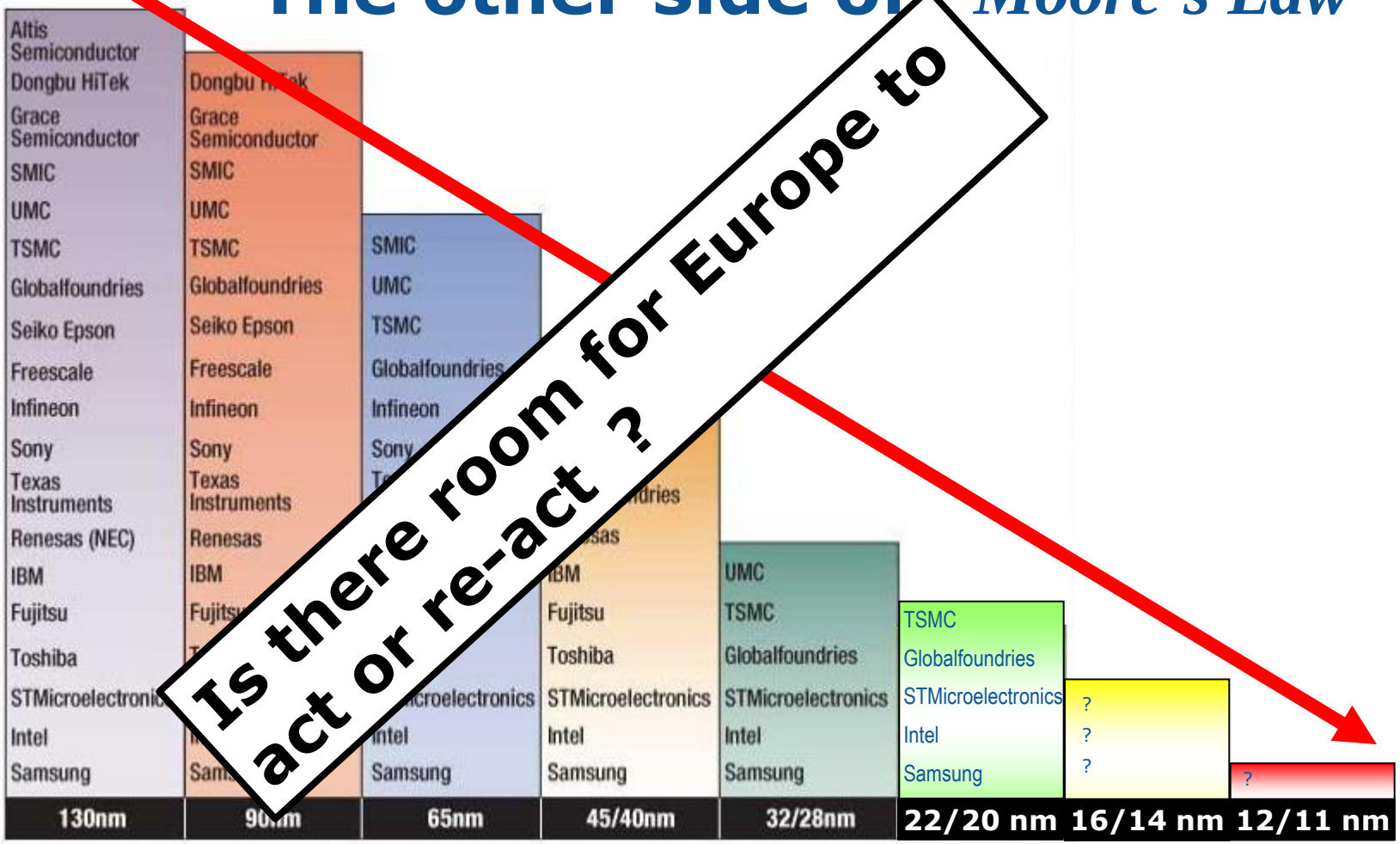


The other side of "*Moore's Law*"



after IHS iSuppli 2011

The other side of "*Moore's Law*"

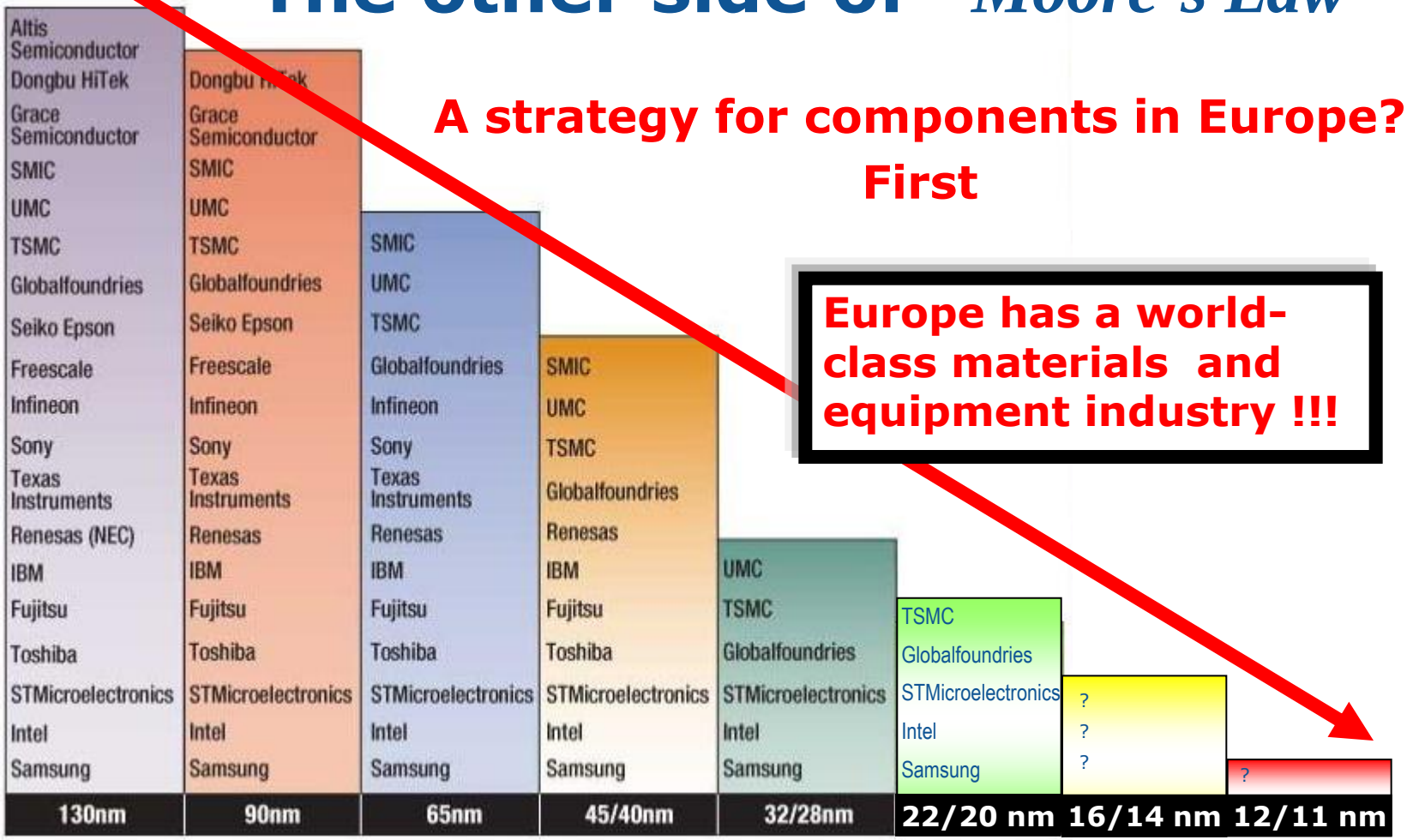


after IHS iSuppli 2011

The other side of "*Moore's Law*"

A strategy for components in Europe? First

Europe has a world-class materials and equipment industry !!!



after IHS iSuppli 2011

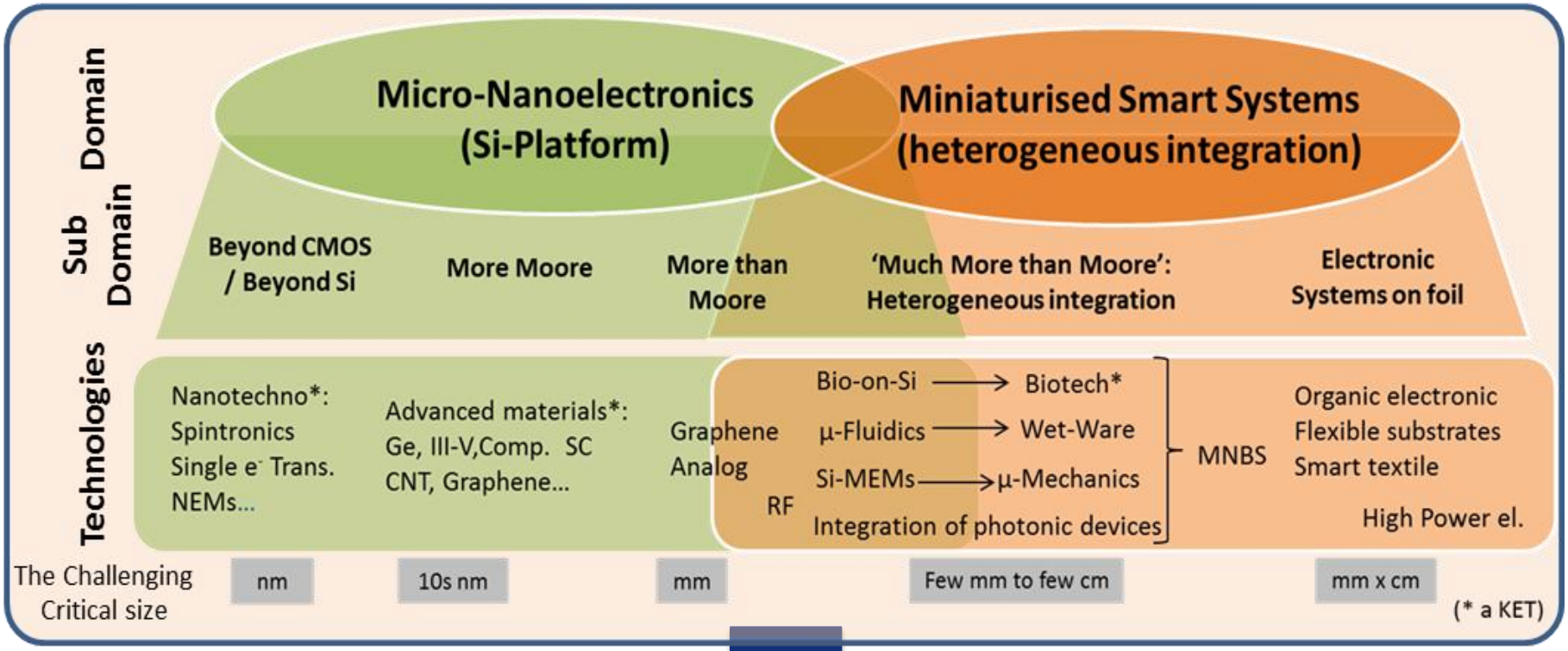
European Commission

A strategy for components in Europe?

Second.

Added value from diversification: There is more than Moore!

From Transistors to Miniaturised Smart Systems
From nanometres to centimetres

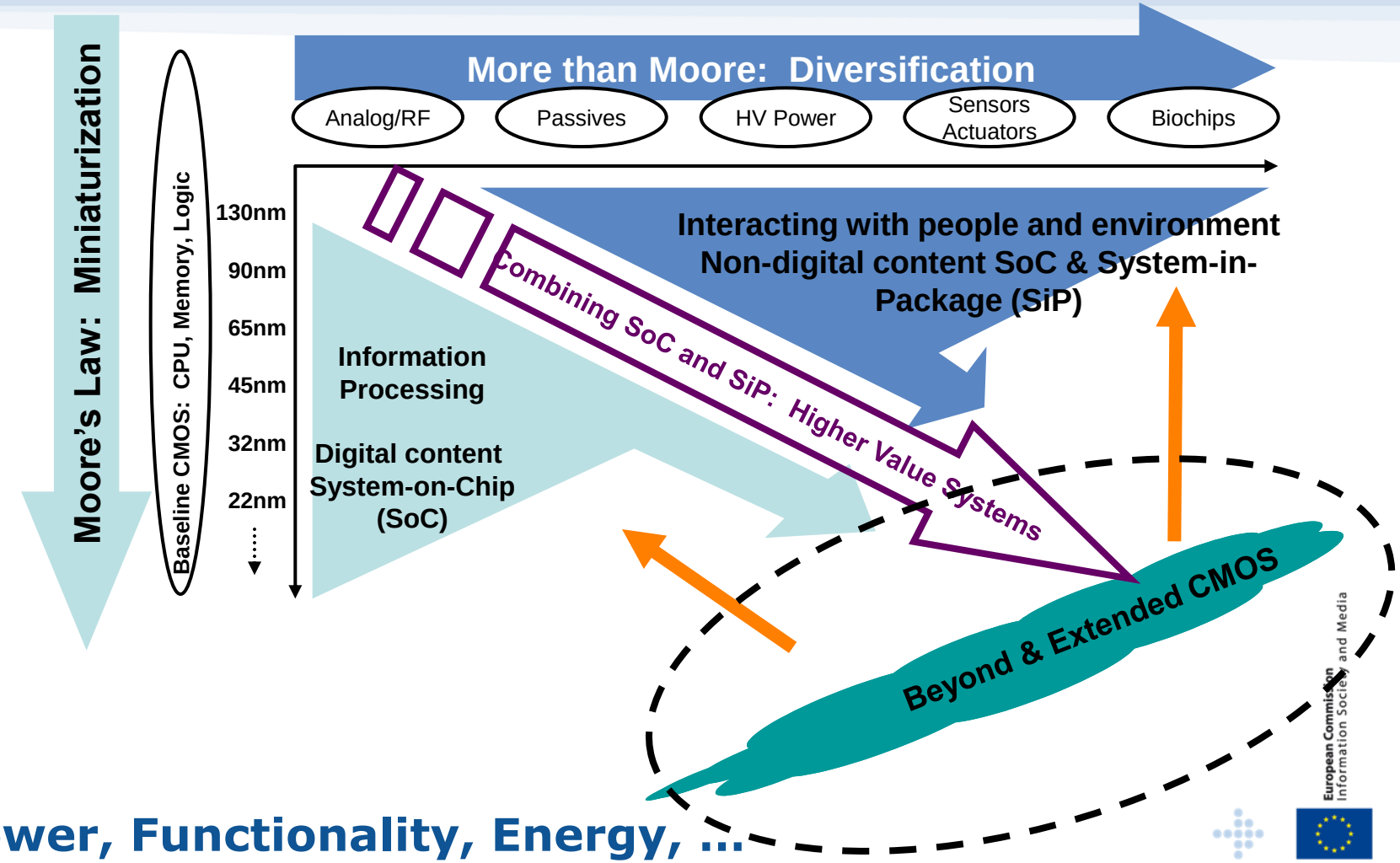


A strategy for components in Europe?

Third

"Small, integrated and smarter

More Moore AND more than Moore



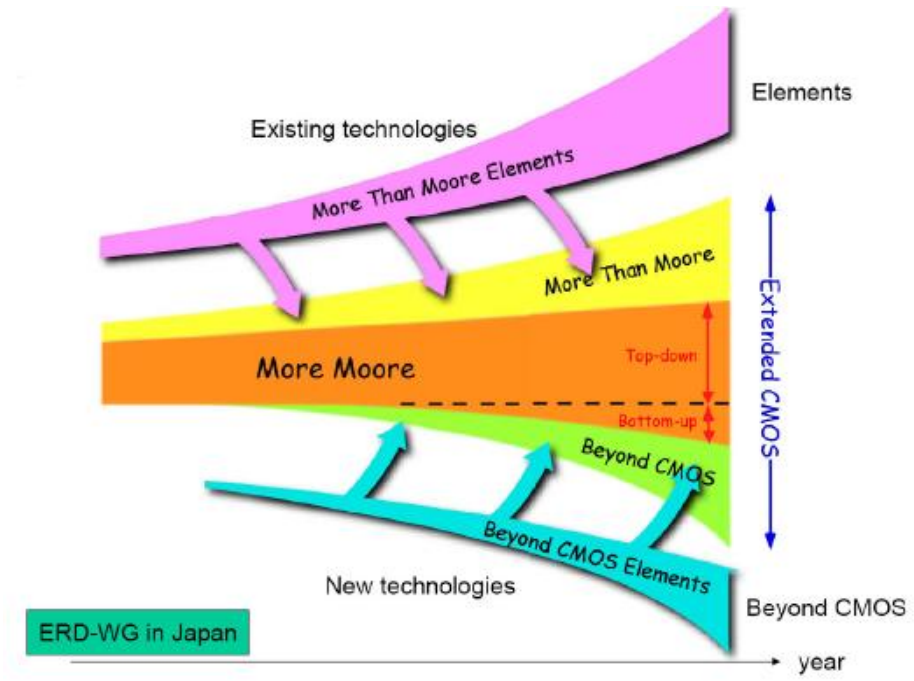
0-Power, Functionality, Energy, …

- Advanced components in advanced systems enabling pervasive applications -

A strategy for components in Europe?
Fourth

(Very) Advanced *Nano-electronics as system enablers and solution providers*

(energy, functionality, system-technology interaction, ….)



ITRS-ERD vision of the role of Beyond CMOS and More than Moore elements to form future extended CMOS platforms.

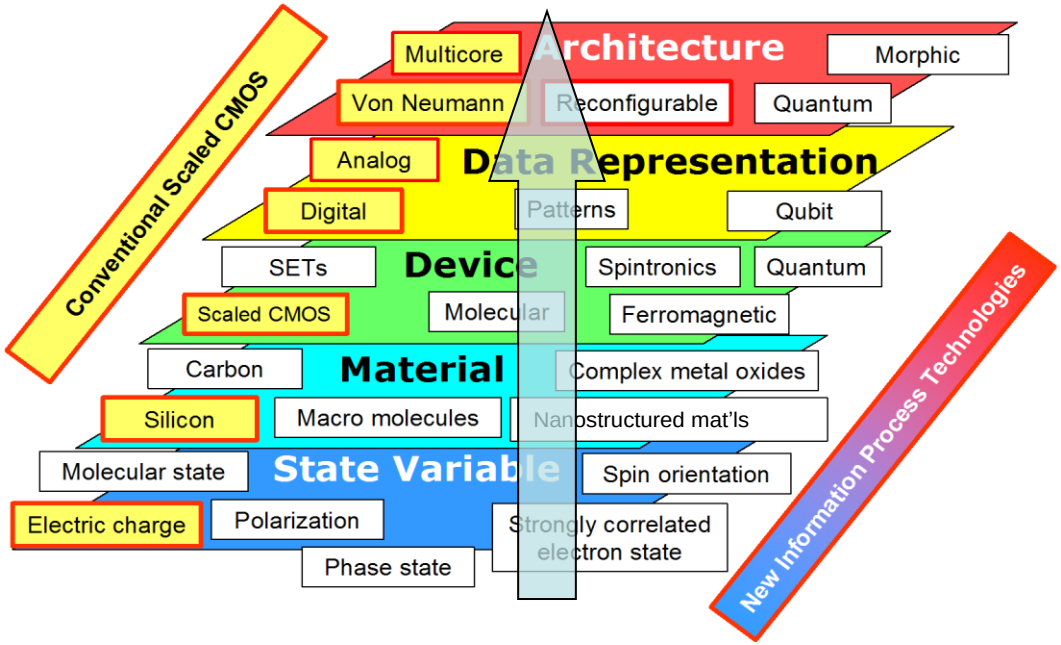
- **Beyond CMOS and advanced More than Moore as an extended-CMOS vision**.
- **Hybridizing silicon** with molecular switches, ferromagnetic logic, spin devices and sensors in order to ***enable heterogeneous and morphic system architectures***.
- **Integrate-ability, system-ability** and **manufacturability** of novel technology and **reliability** are key factors.

A strategy for components in Europe?

Fifth

Multi-disciplinary and system enabling concepts

Transversal Research + **Multi-disciplinary cooperation**



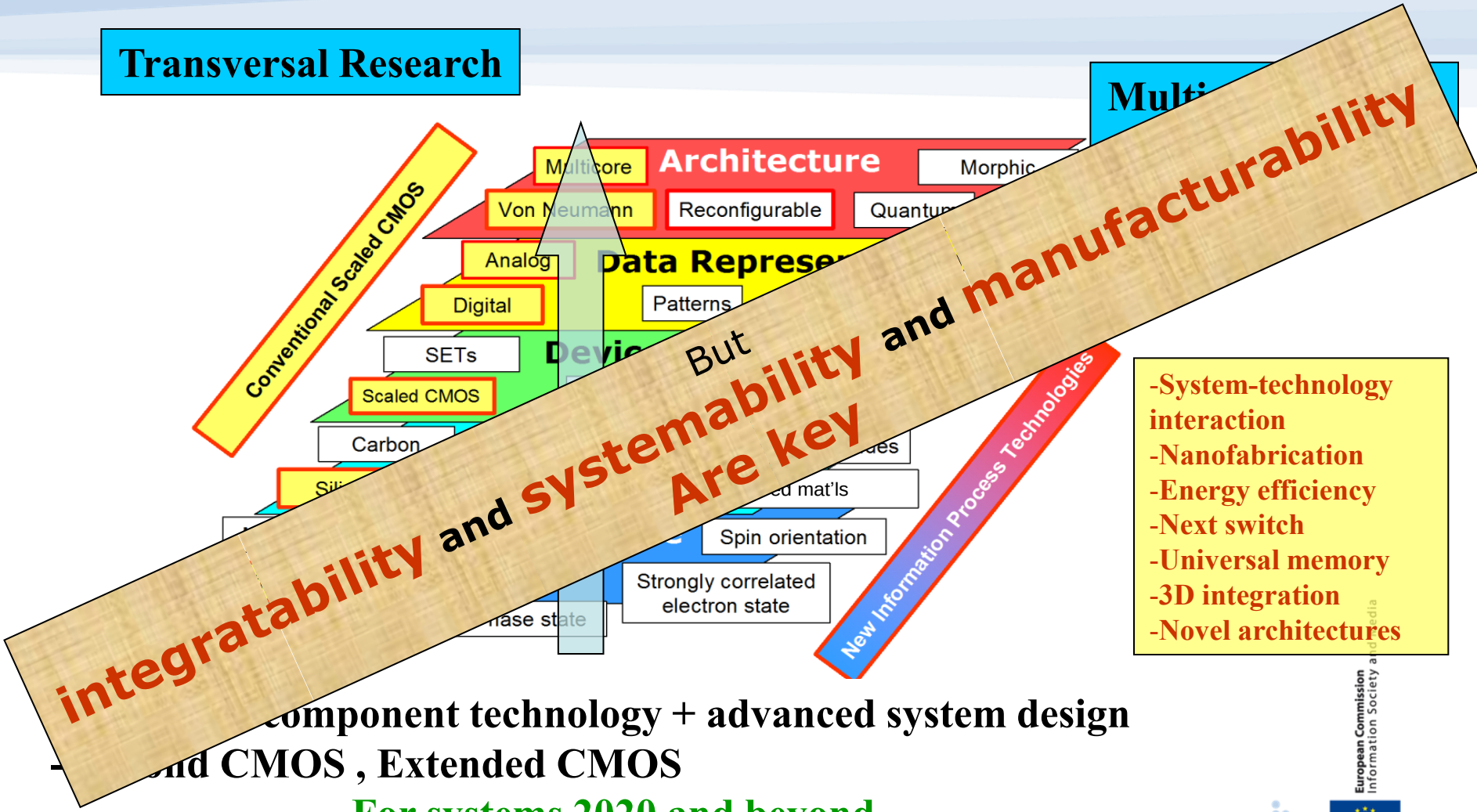
-System-technology interaction
-Nanofabrication
-Energy efficiency
-Next switch
-Universal memory
-3D integration
-Novel architectures

- Advanced component technology + advanced system design
- Beyond CMOS; Extended CMOS

For systems 2020 and beyond

European Commission
Information Society and Media

General system enabling concepts



component technology + advanced system design

– nd CMOS , Extended CMOS

For systems 2020 and beyond

European Commission
Information Society and Media

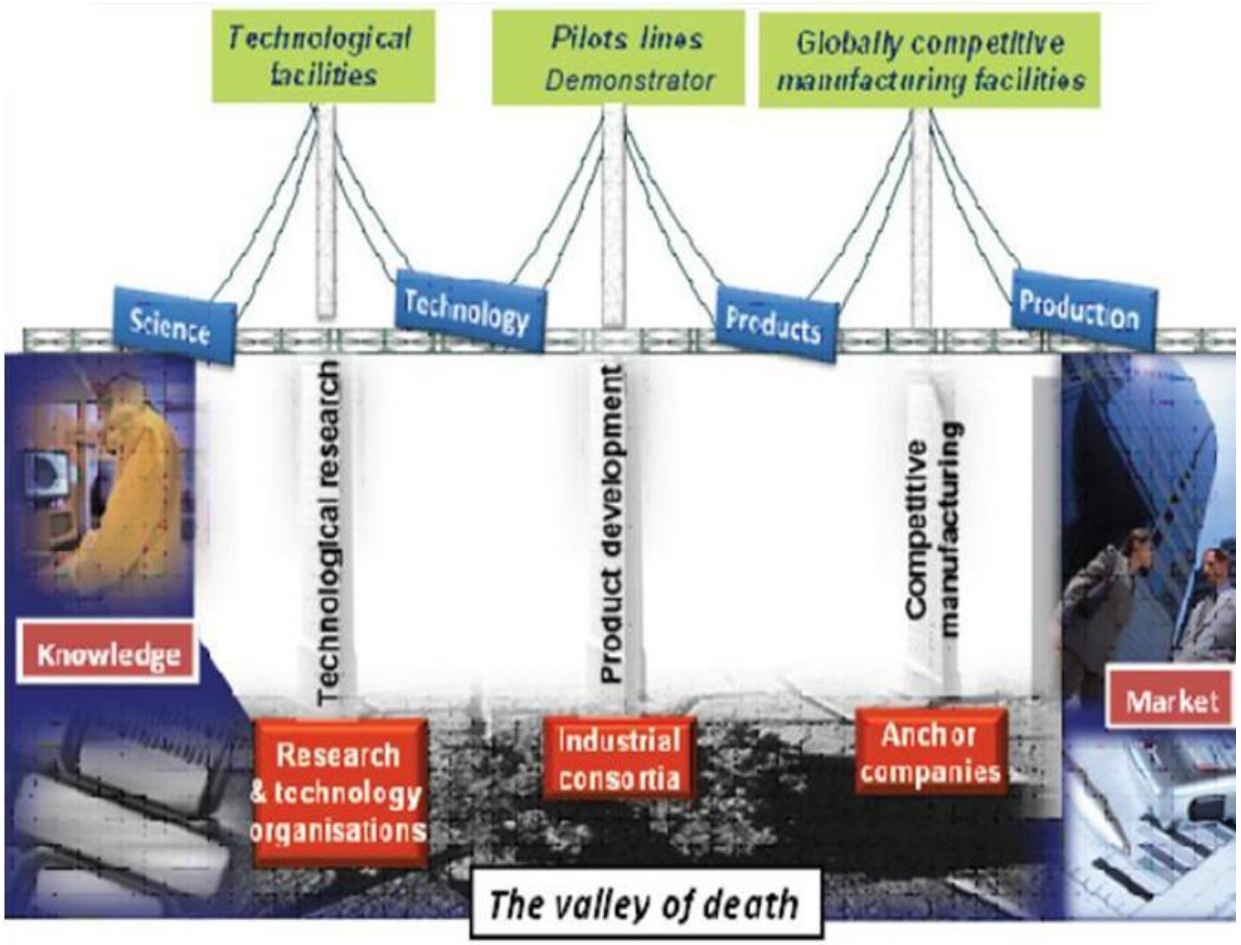
An integrated European industrial strategy on Electronics Components

- An 'aggressive' strategy – beyond business as usual
  - Reverse the trend of declining market share
  - Remain and become a world leader in selected areas
  - Focus on areas of strength

- A bold and 'holistic' approach combining policy instruments
  - **Full value chain** (Research, Design, Manufacturing; More Moore & More than Moore, 200-300-450 mm)
  - **Full innovation chain** (R&I&M, All TRL's bridge valley of death)
  - **Reach critical mass** (MS, Smart Specialisation, …)
  - Additional **policy actions** in line with KET approach (state aid, trade,.)

- Be at the forefront of research and technology development
- Access to finance (EIB, regional funds, …) and **skills**

Address 3 pillars including Pilot Lines and Mfg



One bold initiative
"Airbus for Electronics" (Neelie Kroes)

Bringing together micro/nano-electronics innovation and the application-pull of the system requirements (Smart Systems – Embedded Systems)

Covering the full value chain: equipment and materials, design and system integration – addressing manufacturing and lead markets, combining research, innovation and take-up

Pooling resources to respond to increasing costs of R&D&I – institutionalised PPP (JTI-type) with drastic simplification of the operational model

Opportunities next calls in FP7:
70% increase in period 2011-13

M€	2007	2008	2009	2010	2011	2012	2013	TOTAL
PF7 ICT	1.189	1.217	1.227	1.241	1.382	1.582	1.760	9.597
CIP	58	52	105	113	120	135	149	732

The calls in 2013 will ensure a certain degree of continuity in priorities and at the same time serve as a bridge to activities in Horizon 2020.

Immediate opportunities

Challenge 3: alternative paths to components and systems

✓**3,1 nano/microelectronics, (*between FET (longer term, speculative) and ENIAC (shorter term, industrial)) overcoming barriers in devices and materials, system level limits, energy-efficiency, power density, design complexity issues, and cost*.**

✓**3,2 photonics**

✓**3,3 heterogeneous integration and take-up of enabling technologies for components and systems: *promote convergence of technologies to build energy and resource efficient components and systems and stimulate innovation by well-targeted take-up actions with emphasis on SMEs (users-suppliers*)**

✓**3,4 advanced computing, embedded and control systems at a higher level**

And …….FET

Obj. 3.1 Nanoelectronics

Call 11
18.09.2012 – 16.04.2013
32 M€

- ✓ **Integration of advanced devices and technologies** ***(16nm and below)***
  - ✓ **MM: boost performance:** Ge, III-V, Graphene, CNT, nanowires,..
  - ✓ **MtM: boost functionalities:** analog/Rf, magnetic tunnel junction,...
  - ✓ **Beyond CMOS / Si switches:** spintronics, single electron, NEMS,.
- ✓ **Advanced manufacturing**
  - ✓ **MM, MtM and Beyond CMOS incl 3D**
- ✓ **Design, modelling and simulation**
  - ✓ **For advanced devices, components and systems**
- ✓ **International Co-operation**
  - ✓ **'One action: a European strategy for 450mm in dialogue with G450C, the Us, Korea, and Taiwan'**

European Commission

Call 10
10.07.2012 – 15.01.2013
64 M€

3.3 Heterogeneous Integration and take-up of Key Enabling Technologies for Components and Systems

VECTOR
(Endoscopic capsule)

a) Integrating heterogeneous technologies

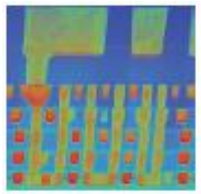
i. Miniaturised smart systems
ii. Hybrid integration of organic electronics and micro/nano electronics
iii. Further development and validation in real settings of micro-nano-bio and bio-photonics systems

Semiconductor Equipment for
Wafer Bonding with Plasma Activation
EV Group, CEA-LETI, Soitec

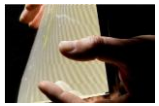
b) Technology take-up and innovation support

i. Assessment experiments in nano-electronics and smart systems
ii. Access services
iii. A network of innovation multipliers
iv. eco-system for smart systems integration
v. Deployment of bio-photonics and micro-nano-bio solutions
vi. International co-operation

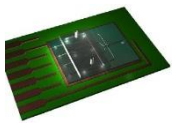
iPHOS (Sub-THZ com)



Metrology Using X-Ray Techniques
Jordan Valley, CEA-LETI,
STMicroelectronics Crolles II,
NXP Crolles R&D



Roll-to-Roll
(Fast2Light)



(PYTHIA (Lab-on-Chip)

Place-it
(ICs on plastic)

Summary FP7 – ICT WP2013

	Budget (M€)	Call 10	Call 11
Date of publication		*10/7/12*	*18/9/12*
Call deadline		*15/1/13*	*16/4/13*
3. Alternative Paths to Components and Systems	***229.5***		
3.1 Nanoelectronics			*32*
3.2 Photonics			*61*
3.3 Heterogeneous Integration and take-up of Key Enabling Technologies for Components and Systems		*64*	
3.4 Advanced Computing, embedded and Control systems		*72.5*	

Concluding Summary (1)

- **EU2020: more needed than ever! Think smarter, greener, competitive – Think jobs and innovation** (action and implement)
- **KET recommendations are major input to industrial policy, regional policy** (smart specialisation)**, competition policy and H2020** driving key budgets and activities in H2020, ESF, EIB, State Aid, Regulation,..
- **Increased demand for multifunctional solutions in emerging markets:** personalised healthcare, security, environment, eVehicle,...
- **H2020 not business as usual** (from Research to Innovation, societal and technology driven, ...)

European Commission

Concluding Summary (2)

- **Nano-electronics/components with a wider system view: A shared bold strategy beyond research and innovation!**
  - Whole value & innovation chain, including pilots & manufacturing to bridge "valley of death"
  - Cooperation and competition at European and International level
  - Strategic partnerships with competitors and users
  - Holistic approach: R&D&I&M and smart policies (regulation, state aid) to bring results in the market and to keep manufacturing in Europe
  - Disruptive advanced technologies & devices
  - Need to align the necessary budget and resources

  An integrated approach for Europe to compete globally.

- **"Advanced CMOS", "Beyond CMOS", "Extended CMOS" : Systemability, Integratability and Manufacturability are key.**

THANK YOU

☺ And get involved in next calls. ☺

Dirk Beernaert

European Commission

DG CONNECT: Adviser for Interdisciplinary and Integrating Activities

dirk.beernaert@ec.europa.eu

DG CONNECT (Communications Networks, Content and Technology) / Horizon 2020 :
http://ec.europa.eu/dgs/connect/index_en.htm
http://ec.europa.eu/research/horizon2020/index_en.cfm

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?"*