

# FP7 - ICT Work Programme 2011-12

## Objective 3.1

*“Very advanced Nanoelectronic components:  
design, engineering, technology and  
manufacturability”*

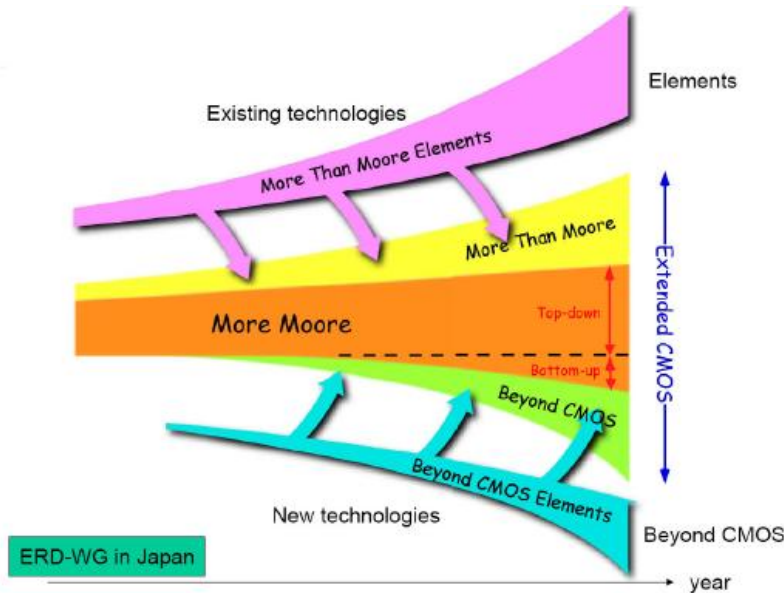
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Information Society & Media Directorate-General  
Nanoelectronics

# Presentation Outline

- Objective 3.1:
  - What are we looking for?
  - General concepts
  - Target outcomes
  - What do we not want?
- Related Objectives or Programmes
- Key groups / Leading players
- Additional background documents

# What are we looking for?



ITRS-ERD vision of the role of Beyond CMOS and More than Moore elements to form future extended CMOS platforms (2010).

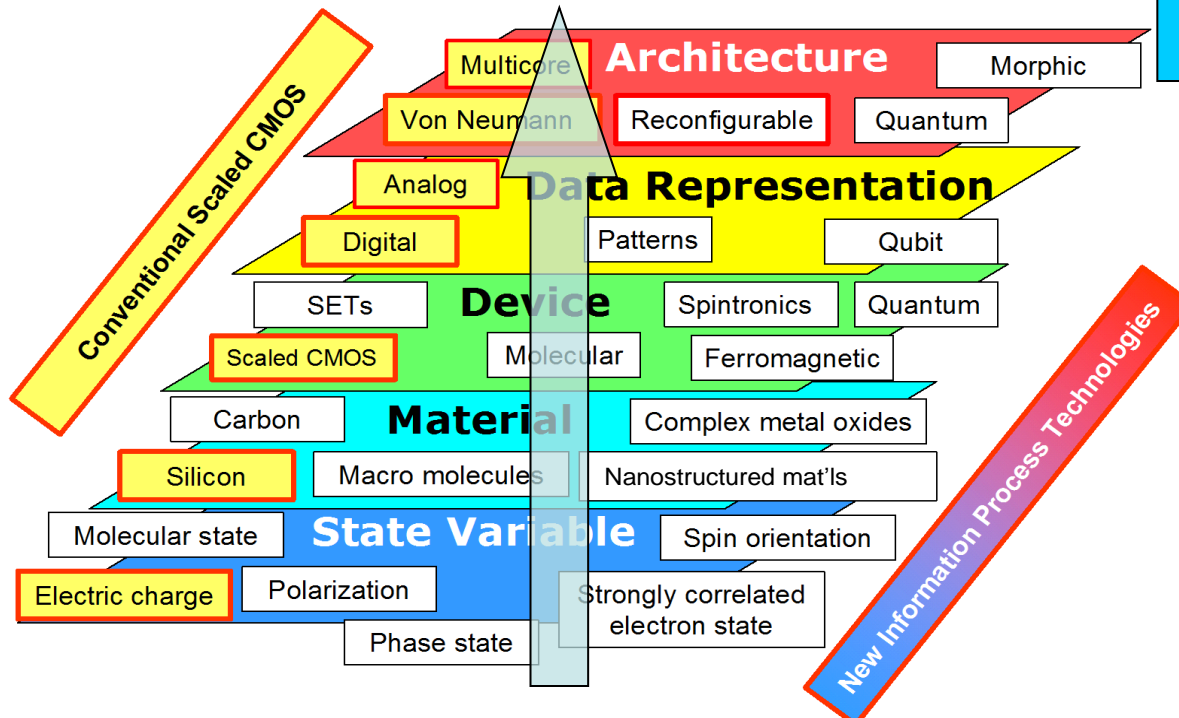
- **New advanced nanoelectronic components** based on “beyond CMOS devices” and their integration with advanced More than Moore elements and with existing and new nano-CMOS to support miniaturised electronic and communication technologies for 2020 and beyond.
- Improved technology, engineering, nano-manufacturing and design solutions for **increased performance, increased systemability, integratability and manufacturability.**
- **Joint equipment assessment and broker services** to facilitate access to world wide market for SMEs and academics.

# Work Programme 2011-12

## General concepts

**Transversal Research Projects**

**Multi-disciplinary cooperation**



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

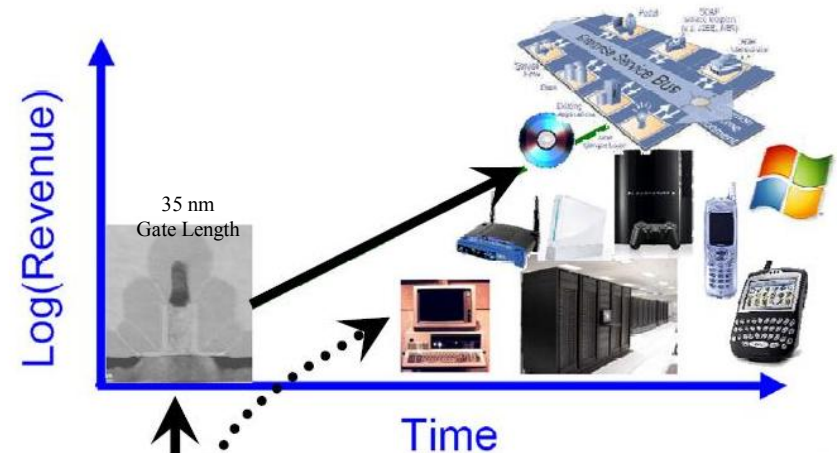
- Advanced component technology + advanced system design
- Beyond CMOS + advanced More than Moore integration with More Moore

**For systems 2020 and beyond**

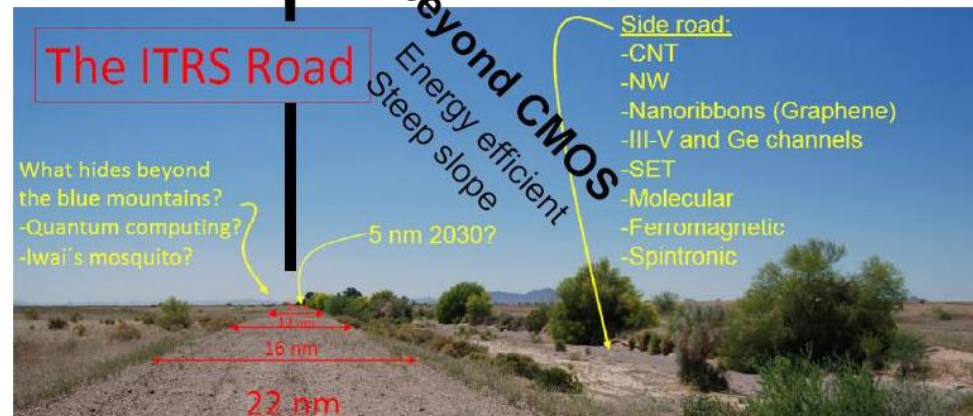
**Systemability, integratability, manufacturability**

# Objective 3.1: Advanced Nanoelectronics Technology

- To stimulate **interaction of system and technology** to better explore European system competences.
- To address **energy efficiency** needs for mobile applications
- Nanoelectronics products as **system enablers and solution providers** for global challenges as aging society, global warming, growing population or sustainable manufacturing.
- To prepare for **“beyond” traditional shrinking** (ITRS roadmap)



Systemability, Manufacturability, Reliability



# Objective 3.1

## Manufacturing and Equipment assessment

- Access to **nano-manufacturing and to advanced technologies** to be assured in Europe.
- Access to world wide **equipment** market for European suppliers, especially SMEs, need to be stimulated.



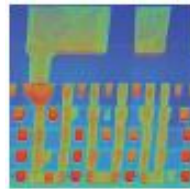
Semiconductor Equipment for Wafer Bonding with Plasma Activation  
EV Group, CEA-LETI, Soitec



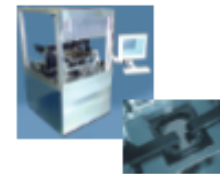
Ruthenium Atomic Vapor Deposition  
Competitiveness in Nanoelectronic Device Generations  
AIXTRON, Fraunhofer IISB, Infineon Munich



Low Energy and Dose Implant Test  
SEMILAB, Fraunhofer IISB,  
ST Microelectronics Crolles II,  
NXP Crolles R&D



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



EVO SmartView® Wafer Aligner  
3D Integration of Bulk Si Wafers  
EV Group, CEA-LETI,  
STMicroelectronics Crolles II

Call 8

60M€

# ICT Work Programme 2011-12

## *Nanoelectronics*

### Objective 3.1: Very Advanced Nanoelectronics Components

a) Beyond CMOS technology	STREPs	55 M€
b) Circuit-technology solutions	STREPs and at least 1 IP	
c) Nano-manufacturing and Joint Equipment Assessment	STREPs and at least 1 IP	
d) Coordination and Support Actions	CSAs	5 M€

### 3.1 Very advanced nanoelectronic components: design, engineering, technology and manufacturability

## Target outcomes

#### a) Beyond CMOS technology

- New switches and interconnects (scalability, performance and energy efficiency gains, operational reliability and RT operation);
- Advanced system integration technology and new methods for computation;
- Emerging memories targeting the concept of non-volatile universal memory;
- Nano-photonic devices & interconnects integrated with nano- and Beyond-CMOS
- Carbon based electronic devices;
- Novel materials for interconnects , nano-packaging, Beyond-CMOS (logic and memory);
- Understanding fundamental artefacts and limits: nano-scale thermal processes; computational material and device science.

Developed components and technologies need to fulfil the criteria of “**systemability**”, “**integratability**”, and “**manufacturability**”.

Funding schemes:  
STREPs

### 3.1 Very advanced nanoelectronic components: design, engineering, technology and manufacturability

## Target outcomes

#### b) Circuit-technology solutions

- Architectures including energy efficiency, spin devices; silicon with molecular switches; ferromagnetic logic; heterogeneous and morphic system architectures.
- Circuit design methodologies and tools
- Technology addressing e.g. device leakage current, power dissipation, ... monolithic as well as 3D integration of Beyond CMOS and advanced MtM.
- Modelling and simulation
- Design-technology solutions for energy efficiency, high reliability and robustness.

Developed components and technologies need to fulfil the criteria of “**systemability**”, “**integratability**”, and “**manufacturability**”.

The **interaction of circuit, device and technology research communities** will be stimulated

Funding schemes:  
IP  
STREPs

### 3.1 Very advanced nanoelectronic components: design, engineering, technology and manufacturability

## Target outcomes

#### c) Nano-manufacturing and joint equipment assessment

- Manufacturing approaches to Beyond-CMOS and advanced MtM, and to their integration with nanoCMOS including 3D integration.
- Enhanced variability control; integrated metrology/inspection/analysis concepts and tools to support 3D approaches; functionalised assembly and packaging.
- Joint assessments of (combined) equipment/metrology/process solutions ranging from proof of concept for “disruptive” approaches and for 450mm to prototype testing with suppliers and users.
- 200/300 mm wafer integration platforms and short user-supplier feedback loops.

Comprising the **complete manufacturing supply chain** for flexible and customised manufacturing of **integrated nano- and Beyond-CMOS** components

Funding schemes:  
IP  
STREPs

### 3.1 Very advanced nanoelectronic components: design, engineering, technology and manufacturability

## Target outcomes

#### d) Support measures

- Broker services to offer European researchers and SMEs access to training, to CAD tools and to advanced technologies, design kits and IP blocks for education, prototyping and small volume production.
- Roadmaps; benchmarks; strategy papers; studies of limits of Beyond-CMOS and advanced MtM processes, devices and architectures.
- Stimulation of young people towards electronics careers.
- International cooperation (USA, Taiwan, Korea, Japan)
- Support, coordination and standardisation actions including preparatory work for 450mm wafer processing targeting material and equipment companies

Funding schemes:  
CSAs

Budget:  
5 M€

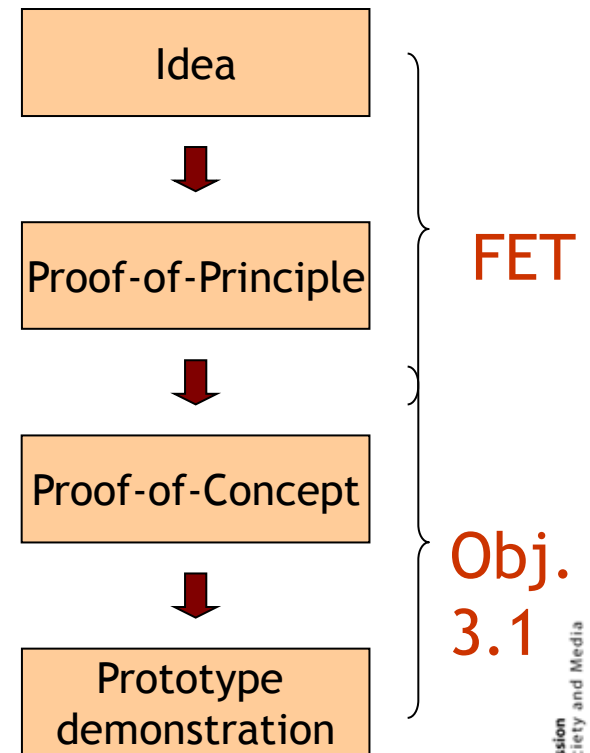
### 3.1 Very advanced nanoelectronic components: design, engineering, technology and manufacturability

## Expected Impact

- **Increased European knowledge, resources and skills** at the frontier of nanoelectronics technology and miniaturised electronic systems, enabling further European partnerships in ww collaborations. European research organisations in leading positions.
- **A more integrated nanoelectronics technology, device and design research community**, better targeted to the business strategy of the European industry.
- **Increased attractiveness for investments** in components miniaturisation, functionalisation and manufacturing in Europe; increased business opportunities and market share.
- **New electronic applications** of high economic and socio-economic relevance
- **Strengthened competitiveness** of the European foodchain for the nanoelectronics industry (materials, equipment and components suppliers, academia and institutes).

# Related Objectives or Programmes

- NMP
- FET
- WP 2011-2012: Obj. 3.1
- WP 2011-2012: Obj. 3.2
- (a) “Future smart components and smart systems”
- ENIAC Programme
- CATRENE Programme



Materials → Equipment → Devices → Components → Systems → Manufacturing

# What do we not want?

- **We want** very Advanced and Multidisciplinary Research, but
- **We do not want**
  - Research on components and technologies that do not investigate the need to fulfil the criteria of “systemability”, “integratability” and “manufacturability”, where appropriate.
  - Research focused on materials
  - Research focused on the development of equipment
  - Research focused on large systems integration

# Key groups / Leading players

## Key Groups

- International Roadmap of Semiconductors (ITRS - ERD)
- Scientific Council of ENIAC ETP
- NANOTEC CA - Building a Nanoelectronics Design and Technology Community (<https://www.fp7-nanotec.eu/>)
- ENI2 Nanoelectronics Infrastructure (<http://www.sinano.eu/sinano/projects/eni2.html>)

## Leading Players

- Leading companies (ST, INTEL, Global Foundries, Infineon, IBM, NXP, Numonyx, ...)
- Leading Regional clusters (Dresden - GF/Fraunhofer; Grenoble - CEA/ST Leuven - IMEC...) and SMEs around them.
- RTO - European Universities of Excellence

# Additional/background documents

- FP7 Workshop on Advanced Nanoelectronics Technologies  
([ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/nanoelectronics/011209-wshop-rep-ai-v7b-clean\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/nanoelectronics/011209-wshop-rep-ai-v7b-clean_en.pdf))
- Workshop on Manufacturing of Beyond CMOS and Advanced More than Moore Devices  
(<http://cordis.europa.eu/fp7/ict/nanoelectronics/elements/wshop-report-v6-fin-070211.pdf>)

# 3.1 Very advanced nanoelectronic components: design, engineering, technology and manufacturability

## Summary

### ➤ Call 8

- Open: 26 July 2011
- Close: 17 January 2012 (at 17:00 Brussels local time)

### ➤ Funding schemes:

- a) Beyond CMOS technology: **STREPs**
- b) Circuit-technology solutions: **STREPs and at least 1 IP**
- c) Nano-manufacturing and joint equipment assessment: **STREPs and at least 1 IP**
- d) Support measures: **CSAs**

### ➤ Indicative budget distribution - 60 M€:

- IP/STREP 55 M€
- CSA 5 M€

# Thank you

## Information Society and Media:

[http://ec.europa.eu/information\\_society](http://ec.europa.eu/information_society)

[http://cordis.europa.eu/fp7/ict/nanoelectronics/mission\\_en.html](http://cordis.europa.eu/fp7/ict/nanoelectronics/mission_en.html)

## European research on the web:

<http://cordis.europa.eu>

<http://www.eniac.eu>

## Contact:

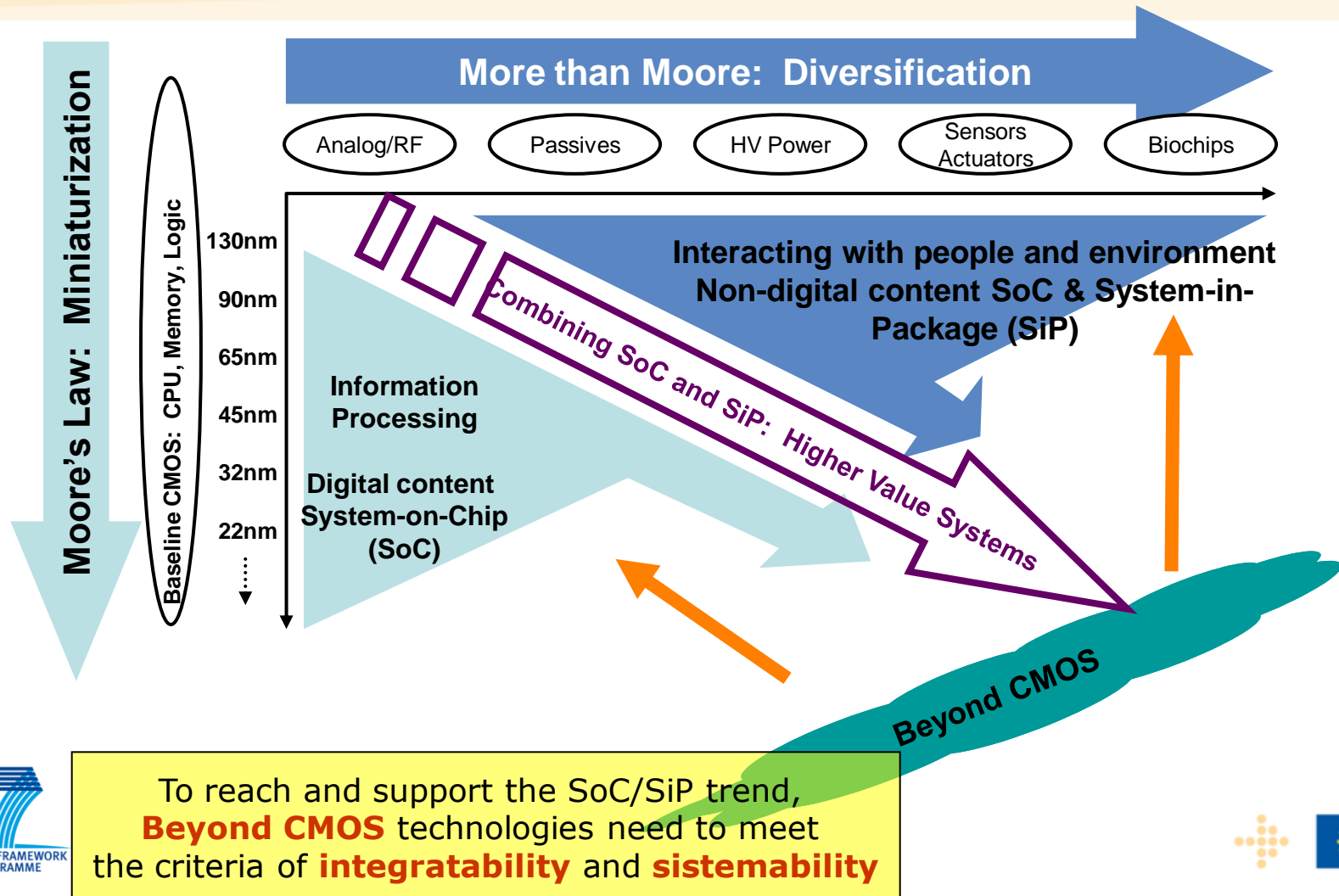
[Isabel.vergara-ogando@ec.europa.eu](mailto:Isabel.vergara-ogando@ec.europa.eu)

# Nanoelectronics in FP7

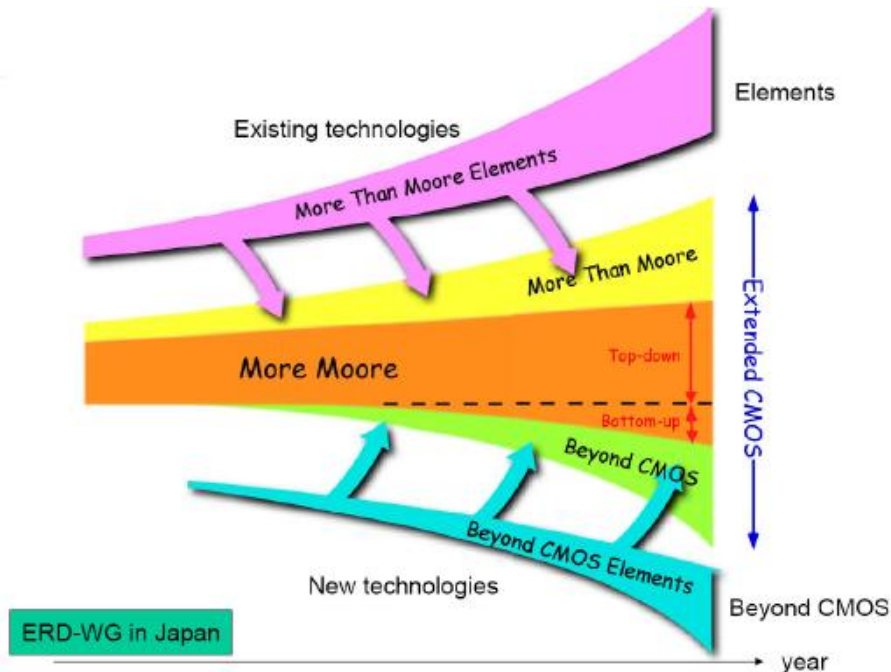
- FP7 - ICT Call 1 (2007): Next-generation Nanoelectronics Components and Electronics Integration. 86 M€
- FP7 - ICT Call 4 (2008): Design of Semiconductor Components and Electronic Based Miniaturised Systems. 25 M€
- FP7 - ICT Call 5 (2009): Nanoelectronics Technology. 35 M€
- FP7 - ICT Call 7 (2010): **Smart Components** and Smart Systems Integration. 38M€
- FP7 - ICT Call 8 (2011): **Very Advanced Nanoelectronics Components.** 60 M€

# Introduction

## European vision of the More Moore and More than Moore domains



# Objective 3.1: Advanced Nanoelectronics Technology



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

- Future developments in **Beyond CMOS** and **More than Moore** as an **extended-CMOS vision**. No disconnection from the advanced silicon CMOS in order to keep impact of its results on the applications and markets.
- Needs of **hybridizing silicon** with molecular switches, ferromagnetic logic, spin devices and sensors in order to enable heterogeneous and morphic system architectures.
- **Integrate-ability** of novel technology with CMOS and their **reliability** become key factors.