Beyond CMOS: NANO-TEC project recommendations
for research in nanoelectronics

Objectives
• To identify the next generation emerging device concepts and technologies for ICT
• To build a joint technology-design community to coordinate research efforts in nanoelectronics

Concept and Methodology
• Workshop series with invited experts
• Benchmark of new Beyond CMOS device and design concepts
• SWOT analysis of benchmark of devices and designs
• Survey questionnaires
• State-of-the-art web platform for discussions, communication, access to information in repository
• Creation of Yellow Pages
• Report on Recommendations

On the Design-Technology Interaction
• Launch projects addressing explicitly technical and methodological aspects of the interactions between the technology and design communities in Beyond CMOS.
• Set up a simple and open infrastructure for design connecting people and things to model and simulate “Beyond CMOS” devices and circuits.

On State Variables
• Target a better theoretical understanding of the underlying physics and material science of nano-scale devices including new device concepts compatible with existing CMOS-based technologies.
• Adress the interconnect challenge at the nano-scale theoretically, experimentally and technologically.
• Combine nanowires technology with III-V compounds and or an alternative architecture to integrate III-V compound NW devices on Si platform.
• Emphasise suitability of fabrication and integration constraints in a combined Si-graphene new ICT technology beyond sensors and single components.
• Address local heating in memristive devices, as well as co-firing, fan-out and scalability bounds. A theoretical framework is mandatory.
• Support research in spin logic
• NEMS research to include a stronger element contact physics, friction and wear at the nano-scale.

On New Computation Paradigms
• Support research in a “super integrated project” or similar to embed solid-state quantum computing and neuromorphic computing in digital environments via digital-analogue hardware and software interfaces.
• Explore novel computation approaches.

On research Infrastructures and Education
• Foster coordination of technological facilities in beyond CMOS research, with a single entry in each EU country.
• Set up a multidisciplinary Beyond CMOS European postgraduate qualification programme to educate a new generation of student in future information processing concepts.

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Summary Recommendations

SWOT of Beyond CMOS in Europe

Strengths
• Application perspective
• Building blocks for innovation in nanoelectronics
• European industrial/academic ecosystem

Weaknesses
• Physical constraints
• Compatibility issues with conventional technology
• Reliability, variability

Opportunities
• Design of circuits and systems
• 3D integration of multifunctional systems
• Industrial/academic cooperation

Threats
• Gap to industrial needs?
• “CMOS competition”
• Manufacturability

Charge-based state variable:
• Graphene
• Nanowire
• Molecular electronic

Non-charge-based state variable:
• MEMS
• Spintronics


European network of academic nanofabrication for nanoelectronics facilities (non-exhaustive).

Copies of the Recommendation Report are available at the ICN2 booth num. M16.