MEDEA+ Scientific Committee

Improving links between MANUFACTURING & SCIENCE

A framework for establishing a more productive industry/research link in support of the competitiveness of the European microelectronics manufacturing

Executive Summary

A widening “knowledge-manufacturing” gap is observed in Europe as the request for scientific expertise from the microelectronics industry surpasses by far the ability of the European academia to provide. It is thus critical to propose a more productive link between industry and research in support of the competitiveness of the European microelectronics manufacturing.

The suggested schemes are different if we are considering the classical CMOS scaling, the addition of functionalities on a circuit or the introduction of nanotechnologies.

The **CMOS scaling** is a very special research field: it is resources and capital expenditure intensive (esp. with the transition to 300 mm wafers), while being extremely time critical. The issues are known along with the timetable (as sketched by the ITRS), most of the ideas exist, but often practical solutions have not materialized. The following recommendations are made:

- **Capitalize on the diversity of Europe** as long as the critical mass of expertise and funding exists, rather than trying to reach the perfect complementary between the different centers of expertise within Europe.
- **Select European Competence Clusters around few locations** (typ. Dresden, Grenoble and Leuven) where state-of-the-art 300 mm infrastructures are operated by major applied research Institutes (typ. CEA-Léti, Fraunhofer Gesellschaft and IMEC). Leverage the cost of these infrastructures through a close link with industrial sites (typ. Dresden and Grenoble) or by sharing the financial burden with non-European regions (typ. Leuven).
- **Complement these European Competence Clusters with networks of academia centers**, strongly linked with advanced industrial sites for manufacturing awareness. These academia centers with a critical mass of expertise, having acquired an international leadership through a constant focus on their field of expertise, should have an organized and funded access to the 300 mm infrastructures. They should have also the capacity to rely on small low-cost flexible additional clean-rooms or labs for value-added exploratory research.
- Capitalize on the excellent European education system and **support academia in making microelectronics industry more attractive**/ stimulating for young people.

Adding new functionalities in a System on a Chip leads the microelectronics research and industry to enter fields often new to them, not chartered by widely accepted roadmaps and where many other R&D and industrial actors may play a significant role. In this domain, where Europe may have a lead, esp. in the telecommunication and automotive markets, the following recommendations are made:

- **Promote teaching of interdisciplinary work.**
- **Promote interdisciplinary campuses**: the innovation 'melting pot' will be favored through the co-localization of education, SME's and small R&D teams. In these ecosystems, the microelectronics industry may find the key competences for their differentiation, as long as it supports the development of an independent (or even competing) expertise ground in Europe.
- **Balance the benefit of an exclusive R&D and the benefit of maximizing the information sharing** and the cooperation network for enhancing the creativity.
- The microelectronics industry should **use the major multidisciplinary R&D Institutes as vehicles** for understanding the new markets, getting access to a broad range of pre-existing knowledge and to make the 'impedance-matching' with the academia network.

- These major Institutes should **organize regular research-industry users' topical meetings** within Europe to enhance the awareness of the European strongholds.

Europe entered early the **Nanoworld** with the European academia as a major player. Unfortunately, the rest of the world is taking over this leadership. In order to regain this leading position, the following recommendations are made:

- **Force early coordination in researches on materials, devices and system architecture of nano-objects**: the challenge of many novel nanotechnologies is less in producing isolated nano-devices than in implementing them in a manufacturable complex system.
- **Organize regular meetings between key researchers and industry senior managers** in order to present the critical assessment of the potentialities of 'emerging' technologies and to confront the optimistic views with the true manufacturing challenges.