

This document has been put together in response to the EPSRC Shaping Capability programme, particularly regarding the area of Microelectronics Design. The document is based on responses received from the eFutures community.

UK Strengths

The UK has an excellent research base and a world leading commercial sector for exploitation.

Examples of strong research include:

- Design tools (ECAD/TCAD)
- Energy efficient and low energy systems
- More than Moore/heterogeneous systems
- Designing around variability in systems
- Beyond CMOS modelling, design and technology
- Asynchronous design
- Embedded Systems
- Processors
- Massively parallel architectures and HPC
- ASICs
- FPGA
- Secure systems
- Mixed mode design
- Biologically inspired systems
- IC Process and Device Modelling and Component Technologies
- TCAD based PDK design for End of Roadmap and Beyond CMOS devices
- Metrology
- Complex Systems and System Design
- Embedded Software
- Radio frequency integrated circuits (RFICs)
- Monolithic microwave integrated circuits (MMICs)
- Radio frequency microelectromechanical systems (RF MEMS)

Some of these areas (*e.g.* FPGA, asynchronous design) are now well established but innovations are still emerging and support should continue. Other areas (*e.g.* biologically inspired and heterogeneous systems) are rapidly growing fields as a result of new insights and innovations in other domains and support should grow to accommodate this expansion. New areas of technology where the UK has strength (*e.g.* organic electronics, autonomous systems) will lead to new design opportunities and again support needs to grow to nurture world class research.

Much of this research is currently well funded by EPSRC, but increasingly relies on cooperation and support from the EU and commercially to maintain its excellence. The UK is fortunate in having a strong commercial sector in electronic systems. NMI, which is a trade organisation representing this sector has in excess of 200 members. World leaders in the UK include ARM, CSR, Imagination and Wolfson.

Microelectronics design could once be considered isolated from the technology platform, but this is no longer the case: device technology is now one of the key inputs to electronic system design. Other inputs include sw, more-than-Moore technologies, optics, mechanics and packaging which all present important new design challenges but have the advantage of being more understandable to the public in general. Design for test, measurement and reliability is also key, particularly as devices get smaller and smaller. Estimates of lifetimes of new devices and products will be essential before launching on to the marketplace.

Fit to EPSRC portfolio

Research on electronic systems is captured within many of EPSRC strategic priorities. For example:

1. “Many core architectures and concurrency in distributed and embedded systems” will include new core designs and embedded system design;
2. “Towards an Intelligent Information Infrastructure” will require design of intelligent systems to minimise data deluge and new design paradigm to handle ever increasing volumes of data;
3. “Working together” The importance of electronic systems is that they underpin so much of the EPSRC portfolio. Most of the grants awarded in Microelectronics Design are part funded from other EPSRC designated “Research Areas”.

Electronic systems also cut across a number of EPSRC themes including Digital Economy, Healthcare Technologies and Manufacturing the Future.

The rate of evolution in electronic systems means that any product more than 5 years old is considered obsolete, however processes, components and objects within them will last for much longer. The underlying technologies and methods have long life and a long gestation period. The increasingly ubiquitous nature of microelectronic systems risks their core research being “lost” as it is eclipsed by their impact, leading to underinvestment. This is similar to what has been recognised in the power electronics sector recently, but is of considerably higher risk to the UK. The area of electronic systems represents around 10% of the UK’s manufacturing sector and employs many thousands of people. Innovative design is an essential component of this with many strong clusters across the UK. Worldwide this \$300Billion industry is driving a \$1.7 Trillion electronic hardware industry with significant contribution from the UK.

Electronic systems, both personal and those supporting our infrastructure, underpin our Economy today and this dependency will grow in the future. Electronic Systems are already the result of international work and cooperation, and it is important that the UK maintains (and grows) its share of work in this life-cycle, if we are to maintain our international value. The lost opportunity cost from under-investing in this sector will impact in other aspects of the EPSRC portfolio. Within ICT it represents not only a fundamental building block which is still evolving to close the gap between what state of the art technology can deliver compared with what can be designed. It also represents a fertile ground for innovation, in particular working across discipline boundaries, where there is evidence of success previously. To develop the UK’s role in electronic systems it is vital that EPSRC continue to encourage and support cross-disciplinary research.

Going Forward

eFutures evolved from previous EPSRC funded networks concerning microelectronics design and technology. These earlier networks worked alongside EPSRC in order to define Grand Challenges, which shaped the UK research landscape at that time. This led to a significant improvement in research grant support for the community, representing a better environment for us all. As EPSRC translates to being a research sponsor, a continuing dialog through eFutures among other initiatives and events is essential. The community that eFutures seeks to represent recognises the value of working together in order to improve our research and align it to the national interests. Defining the national interest requires input from all stakeholders, academic, commercial and funding agencies. Opportunities to promote this dialogue include existing events, such as UKDF or the NMI Summit, which draw the UK community together.

eFutures

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