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Embedding innovation

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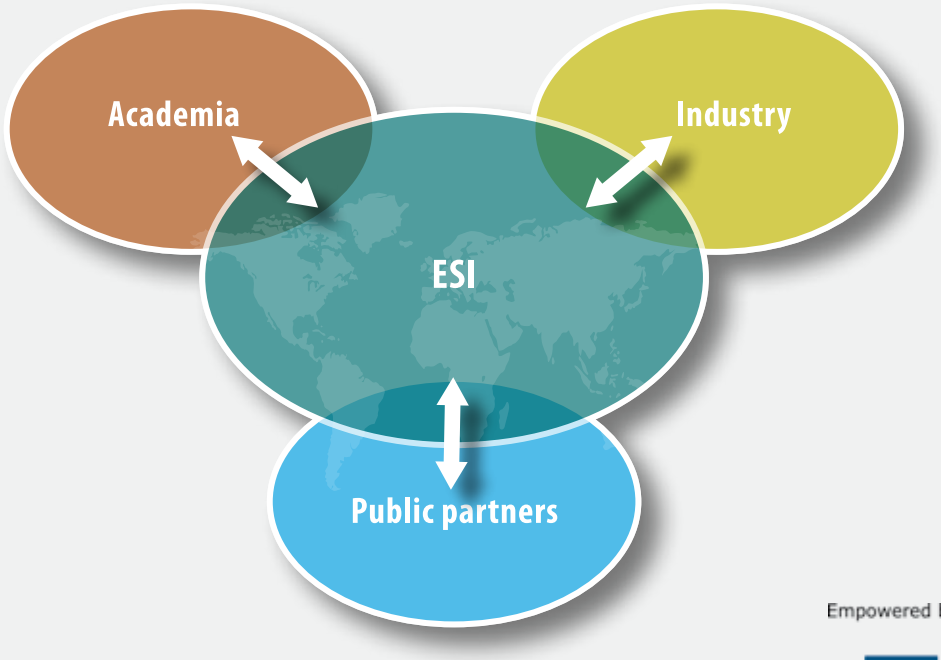
Connecting knowledge & technology



Empowered by

Ministry of Economic Affairs

Strong open-innovation partnership

Located in the region of Eindhoven, Leuven and Aachen, one of Europe's most research-intensive regions, the Embedded Systems Institute (ESI) is a leading research institute that focuses on embedded systems technology. It distinguishes itself through its open innovation approach, with strong connections with academia and industry and a strong focus on research valorization.

ESI was founded in 2002 by industry and academia as a public–private answer to the emerging significance of embedded systems technology in industrial- and societal applications. Its founding partners are ASML, Océ Technologies, Philips, TNO and the Technical Universities of Delft, Eindhoven and Twente in the Netherlands.

The mission of ESI is 'to advance industrial innovation and academic excellence in embedded system engineering.' But of course, there is much more to this remarkable organization. As the following pages reveal…

Special attention is given to:

1 Development of the ecosystem through strategic partnerships for knowledge creation & valorization.

2 Creating and integrating new embedded systems engineering knowledge that fulfills the needs of the stakeholders.

3 Consolidating embedded systems engineering knowledge as a strategic asset.

4 An active programme of knowledge dissemination, with transfer to all stakeholders (industry, societal partners & academia).

5 Training & development of people in the relevant competences.

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Shaping the future

Embedded systems are the soul of today's high-tech products. Like the neural system in the human body, embedded systems sense, command and control operations through an integrated complex of hardware components and software code. Without this highly complex embedded technology, even the sharpest lens, most powerful engine or most precise laser beam would be rendered useless.

Well designed embedded systems are at the heart of most technology advances. Healthcare diagnostics, traffic management, security provisions, manufacturing – all rely on systems based on this core technology. And while embedded systems technology provides us with significant advances in quality of life, our ever-increasing dependency on these complex solutions also brings with it risks in case of technology failures.

The future aspirations of industry and society depend heavily on our ability to develop state-of-the-art embedded systems with the highest possible performance, reliability and security. Growing system complexity also places demands on the evolvability of embedded system solutions: will today's design investments still be able to meet tomorrow's needs?

The Embedded Systems Institute is at the heart of a leading industrial and academic ecosystem for embedded and high-tech systems design in the Netherlands.

It combines the knowledge and expertise of the world's leading academic minds in this field with the innovative capabilities of some of the most advanced industrial companies worldwide. By joining forces and acting as an accelerator for knowledge development and transfer, ESI is an essential driver for tomorrow's technology innovations.

Advancing society

The vision of ESI is to contribute to technological solutions that benefit society. The specialized expertise of ESI can make a valuable contribution, especially where complex systems or system applications are needed to address societal needs.

The main areas of interest within the societal domain are:

1 Safety & Security

Surveillance and monitoring of maritime or military coastal areas can be a critical issue. Smugglers, terrorists, polluters or other trespassers need to be identified in real time to alert the relevant authorities. Other monitoring systems, such as emergency aid or property surveillance, will in the future become more and more sophisticated and integrated in real time with emergency response teams.

2 Health & Wellbeing

The next generation of complex medical equipment such as MRI scanners and electron beam microscopes will play an ever-increasing role in early diagnosis and therapy of diseases. Robotic surgery, intelligent and online telecare systems and biomedical analysis are just a few examples of applications where advances in embedded systems technology will provide significant future breakthroughs.

3 Transport & Logistics

To improve road safety and traffic flows and to increase sustainability, vehicles and traffic management systems require a variety of embedded, networked solutions that operate flawlessly in connected, highly reliable and evolvable system-of-systems configurations. Logistic systems with highly automated transport and storage solutions provide exciting opportunities to maximize transport efficiency.

4 Energy & Environment

The need to ensure reliable energy supplies, with new developments for decentralized and sustainable energy production, requires the development of innovative distributed infrastructures. Similarly, environmental concerns will require new technologies and applications to minimize and process waste streams.

All of these emerging societal applications will rely heavily on innovative embedded system engineering solutions.

Advancing high-tech industry

The vision of ESI is to contribute to the technological advances of the high-tech industry, both for original equipment manufacturers and small & medium enterprises.

The development of a successful high-tech system or system-of-systems application relies on the ability to perform state-of-the-art embedded system engineering within a rapidly changing technology and market environment. This technology forms the cradle of future high-tech intelligence, in both products and services. The next generation of high-tech products, such as medical devices, consumer products, automobiles or manufacturing applications, will strongly depend on the evolution of embedded systems technology.

ESI provides expert know-how, both in theory and practice, to design highly complex embedded systems, for example by developing new methods and approaches to predict, analyse, realize and improve desirable system characteristics.

Focal areas in embedded systems engineering are:

1 Embedded system performance

Embedded system performance is a differentiating factor for most high-tech embedded system applications. Design for system performance increasingly requires a multidisciplinary approach with multi-objective trade-offs (such as power, cost, accuracy and speed) to create highly optimized systems that are successful in the market.

2 Embedded system reliability and security

Embedded system reliability and security are key design considerations, not only for safety critical systems, but for all types of embedded systems. Undesired emergent system properties resulting from unproven technology and undesirable feature interaction may threaten system reliability. Similarly, since embedded systems do not operate in isolation, they are vulnerable to all kinds of security attacks. A range of theories and methods are needed to predict, analyse, improve and certify the reliable and secure operation of embedded systems.

3 Embedded system evolvability

A main challenge is the design of embedded system architectures and functional components that give flexibility to support multiple product generations or future product applications. This requires theory and methods that address the re-use of design assets within an environment of continuous technology and product evolution.

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Accelerate innovation partnerships

ESI is a platform at the heart of the Dutch high-tech ecosystem that consists of renowned national and multinational high-tech enterprises, together with public partners for knowledge development and globally leading academic research groups, of which the three universities of technology in the Netherlands (TUD, TU/e, UT) provide a wide variety of core competencies in embedded systems technology. The focus of high-tech industry is on product development, in which the ever increasing global competition requires it to provide reliable, feature-rich products at lowest costs and shortest time-to-market. Industry's innovation challenges are multidisciplinary by nature. The focus of academia is on the development of the scientific domain, making knowledge widely accessible, mainly through scientific publications. Their research challenges emphasize the in-depth exploration of dedicated promising future technologies or applications. As a result, a third party is needed with a specific focus on combining these individual strengths by providing an open innovation platform for cooperation and valorization of research.

Six strategies are the core of ESI's approach to bind and accelerate the partnership relations:

1 **Agenda & programming:**
Translation of industrial and societal knowledge needs into strategic research roadmaps, programmes and projects.

2 **Exploratory research:**
Exploration of major research challenges and future solution domains.

3 **Applied research:**
Execution of large-scale applied research programmes based on strategic research questions driven by industrial or societal technology needs.

4 **Knowledge consolidation:**
Development and maintenance of a sustainable knowledge base for future applications.

5 **Knowledge dissemination:**
Transfer of knowledge through network activities, seminars, workshops, events, publications, expert circles, training etc.

6 **Competence development**
An educational programme for training of professional competences in system architecting and engineering.

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Reliable and powerful Open Innovation

The creation of an open innovation ecosystem is generally regarded as one of the best ways to address industrial challenges in the area of innovation and exploitation of new technologies. This applies to the Netherlands, the rest of Europe and globally, as the complexity and costs of the problems to be addressed are beyond the scope of individual organizations and industries.

In embedded system engineering, ESI is the national platform for open innovation. Over the years it has built a solid reputation as a capable, reliable and highly committed partner. Its leading national and international network provides one of the best global sources of knowledge and expertise.

ESI stands for the following crucial needs:

1 **National ecosystem:**
A state-of-the-art knowledge infrastructure to create economic and societal added value.

2 **Strong partnerships:**
Extensive industrial and academic networks, both national and international, with broad sharing of knowledge and expertise.

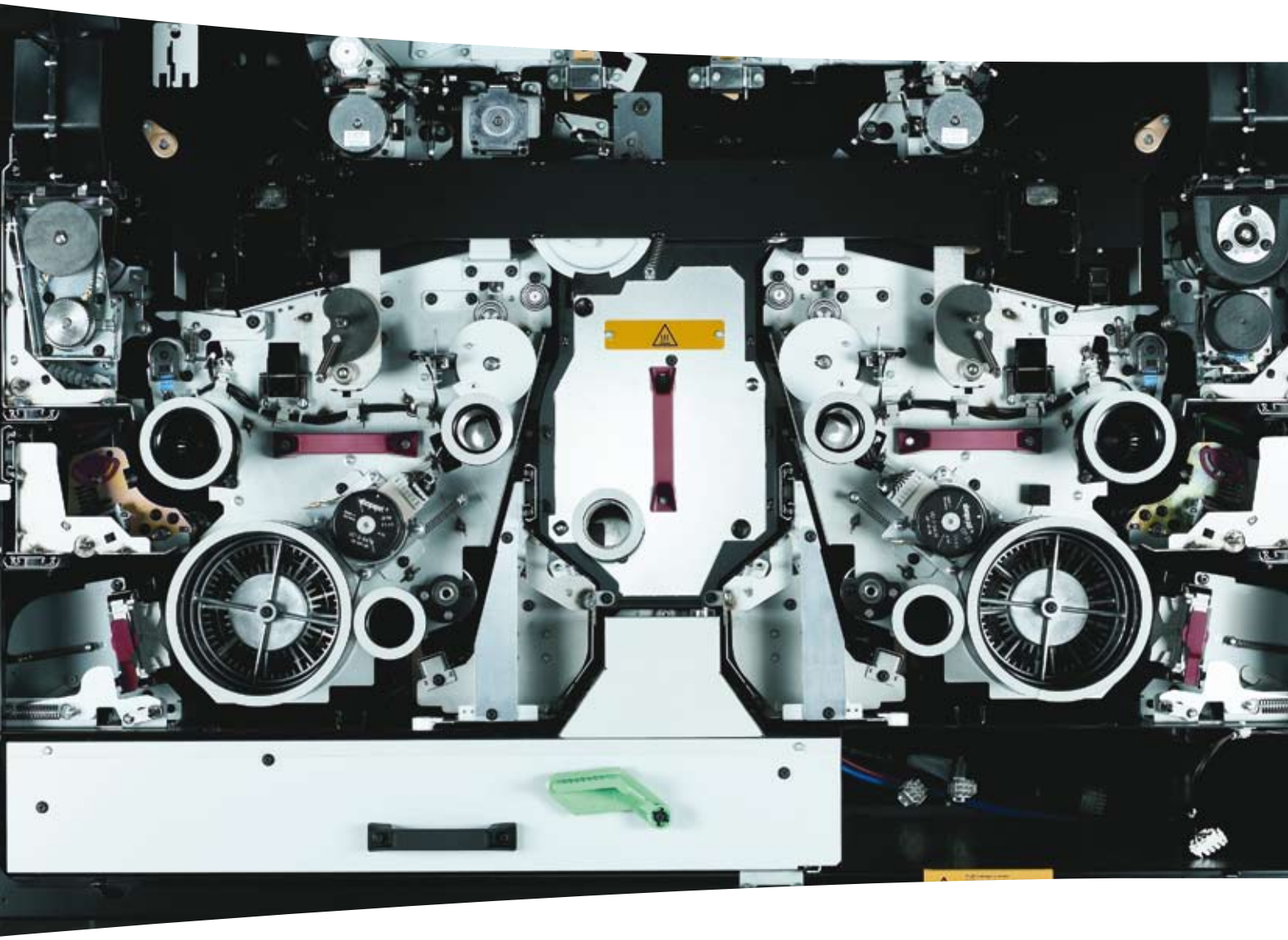
3 **Industry focus:**
Strategic pre-competitive research programmes with breakthrough results.

4 **Societal focus:**
Deployment of know-how for societal advances.

5 **Academic excellence:**
Globally recognized, leading scientific results.

6 **Economy of scale:**
Significant research volume
(mainly based on 4-year projects).

7 **Valorization process:**
Attention to the entire valorization process, including research programming, research execution, knowledge consolidation and dissemination.



Researching tomorrow's solutions

Focus on system aspects & generic knowledge creation for embedded system engineering as a mature, scientifically-based engineering discipline, in particular:

- Embedded system & systems-of-system architecting
- Model-driven system engineering
- System-level control
- Resource planning and scheduling
- System test and integration
- Technology platforms & re-use

Main embedded system desirable properties to attain are

- High performance
- High reliability and security
- High evolvability
- Low energy usage
- Cross-cutting optima, e.g. best performance at low cost/energy combination

Consolidation of methods and technology for the design of:

- Professional/industrial high-tech systems
- Consumer electronics
- Technical infrastructures

Embedded systems find application in a variety of societal sectors, such as:

- High-tech systems industry
- Public safety & security and defense
- Healthcare & wellbeing
- Transportation and logistics
- Energy generation, distribution and usage
- High-tech agriculture

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