TOWARDS A VISION OF INNOVATIVE SMART SYSTEMS INTEGRATION

EPoSS

European Technology Platform
on Smart Systems Integration

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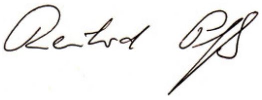

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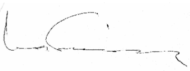

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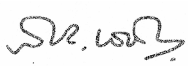


1 Introduction

With the objective of turning Europe into the most competitive and dynamic knowledge-based economy in the world[1] by 2010 – as the basis for an economic area able to achieve sustainable and sustained economic growth providing more and better jobs, greater social cohesion and improved environmental protection - European governments have set an agenda that highlights the current challenges facing Europe.

> During the next decade the European Union has the strategic goal of becoming the most competitive and dynamic knowledge-based economy in the world…

Low economic growth has weakened Europe's competitiveness during the past decade. The European Union has fallen behind its global competitors. There is fear that Europe risks entering a process of de-industrialisation. Economic growth of the European Union, at 0,8 % in 2003, is disappointing for the third year in a row: average growth was about 1,25 % in recent years compared with 2,7 % in the second half of the 1990s.[2]

Successful implementation of the Lisbon strategy is ever more pressing when one looks at the increasing growth gap between Europe and North America or Asia. To make matters worse, Europe has to deal with a slow-growing ageing population, with consequent problems for financing welfare systems. Resources diverted for this from productive investment will be tied for a long time to come.

Europe's productivity growth has slowed. While the average annual growth of labour productivity per hour declined in Europe by a full percentage point from 2.5% in the first half of the 1990s to 1.5% over 1996-2003, productivity growth in the US rose by a similar amount to 2.4% per year.[3]

Competitiveness and productivity go hand in hand. A high and sustainable increase in productivity fosters competitiveness and leads to improved living standards. Investment incentives through market reforms, reorganisation of working methods by using information and communication technologies, raised innovation capability through human capital development (training and further education) and investment in R&D, transformation of innovative products into marketable offerings, solvent markets for these products and services – these are all key factors tending to raise productivity and competitiveness.

Analysis of the key factors underlying Europe’s lack of competitiveness concludes that one of the main reasons for the slowing of productivity growth is weakness in fully exploiting information and communication technologies to transform innovative research results into innovative products. Europe is not short of innovative ideas; it fails to develop innovative production technologies and products.

Europe is behind the USA and Japan in R&D expenditure, even if the latest figures show

[1] European Council, 23 + 24 March 2000, Lisbon, conclusions of the chair, paragraph 5

[2] Report of the Commission at the spring conference of the European Council "The Lisbon strategy implement reforms for the enlarged European Union", 20/2/2004, Brussels, COM (2004), 5ff

[3] Key Figures 2005 on Science, Technology and Innovation Towards a European Knowledge Area, 19 July 2005, p. 1

that overall investment in R&D is slowly increasing[4] and approaching 2% of GDP, the highest level yet. Average annual growth of 1,3% is well below the levels of Japan and the USA and far too low to reach the Barcelona target of 3% by the year 2010.

In 2003, R&D intensity in the EU amounted to 1.93%, well below the US (2.59%) and Japanese (3.15%) intensities, but above China (1.31%). The rate of growth of EU's R&D intensity (+0.7% per year between 2000 and 2003) is far from sufficient to reach the 3% objective in 2010: if this trend remains unchanged, EU's R&D intensity will be only about 2.20% in 2010.[5]

Improvement can only come from a stable and competitive industry with a high rate of product innovation and a strong lead in technology. The technological lead has to come from broadening production from macrotechnology to micro- and nanotechnology. At the same time, it is essential to accelerate the transformation of resourse-intensive sectors into knowledge-intensive sectors. This requires the establishment and the expansion of competitive systems of (more product-technology-based) R&D, favourable framework conditions, an adequate system of education and training, and a supportive R&D infrastructure.

The possible relocation of R&D as a result of Europe's weaknesses is a real danger. Especially in research-intensive high-technology sectors like pharmaceuticals and biotechnology, companies are increasingly carrying out their research elsewhere, e.g. in the U.S., because of the more favourable regulatory, structural and financial environment as well as the availability of skilled labour. A 2001 European Round Table (ERT) study found that major European companies were threatening to invest a great part of their R&D resources in countries outside the European Union – where 40% of European R&D investments are made already – unless framework conditions within Europe undergo drastic changes. Thus there is a real danger of science- and knowledge-based activities which could improve living standard in European countries being marginalised.

The key for change lies in knowledge-based activities. European industry faces a number of challenges: modernisation, higher flexibility, qualitative improvement of products, security of jobs in industry, and optimal use of resources. The mutual dependency of companies within the value-added chain, which reaches from resource inputs to the final product, requires common interdisciplinary research. To undertake this research means tackling certain problems in a sustainable way.

> "Innovation is not only limited to high tech sectors of the economy, but rather is an omnipresent driver for growth"
>
> Erkki Liikanen, EU Commissioner for Enterprise and Information Society, 2003

These problems encompass the use of information technologies within products and processes, tools for speeding up their development, closing the gap between research and production, new approaches to organising services and logistics as well as the deployment of human resources. Sustainable development also means less material consumption and fewer processing steps, thus enabling

[4] European Competitiveness Report, SEK (2004) 1397, 8/11/2004, p. 54

[5] Key Figures 2005 on Science, Technology and Innovation Towards a European Knowledge Area, 19 July 2005, p. 2

products which are more reliable, of higher value, and more cost-competitive. This in its turn will generate and safeguard competitiveness.

To achieve all of this requires the development and introduction of new elements of process management and manufacturing. Redesigning European industry means training and motivating highly skilled labour. Diversified know-how, a solid bedrock of scientific and engineering skills, interdisciplinary approaches, and a capacity for co-operation are prerequisites for the innovation competence needed. This innovation competence, built on "knowledge" and "knowhow", on emerging and implemented ideas en route to the market, could generate commercially successful products and services.

> There is no lack of new ideas in the European Union but failure in converting ideas into new products and procedures.

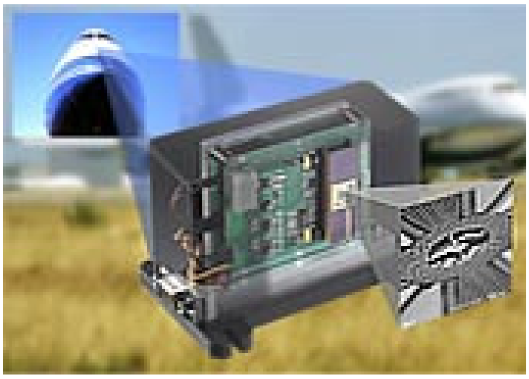
In order to establish the European Research Area and to increase research investments, the European Commission is encouraging the creation of European technology platforms in key areas of technology development.

These European technology platforms bring together public and private interests in order to develop a common vision and strategy for the development and use of key technologies. They aim to encourage greater mobility in research and to address non-technical barriers. Technology platforms can also support sectoral competitiveness. Hence they can contribute to the development of Europe as a competitive industrial location and profitable target for investment, as an attractive market with strong domestic demand, a research-and innovation intensive region highly attractive for researchers and developers, and an attractive living environment for its population.

2 Smart System Integration – at a glance

Future product generations will be smart integrated systems of increasing complexity which use the convergence of a whole range of technologies for the improvement of the characteristics of the overall system.

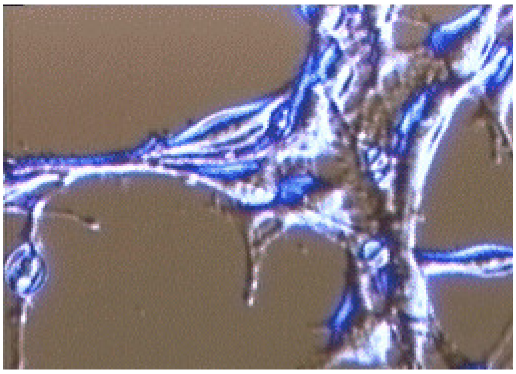
It is Smart System integration which will release the full product potential of "enabling technologies" like nanotechnology and biotechnology.



These systems are often networked, energy-autonomous, miniaturised, reliable. They are becoming increasingly complex, involving other disciplines and principles. Often operating within larger systems they are embedded in, they interface with each other, with their environment and with the individual persons. New features like ubiquitous information, security, ease-of-use or the integration of mechanical, optical or biological functions will be developed using different technologies.

Intense international competition calls for rapid product change and shorter time to markets. A broad range of diverse materials and a wide variety of technologies have to be developed and integrated. Smaller and smarter by transdisciplinarity will be the key issue in the future, systems integration the major challenge.

The evolution of the critical dimension of technologies into the nanometre scale, together



with the exploitation of completely new physical phenomena at the atomic and molecular levels, has given new momentum and opened opportunities for new solutions to old and new problems in bioengineering, the environment, human-machine interfaces, and many more. The integration of cognitive functions gives rise to a new concept of converging technologies (NanoBioInfoCogno).

The ability to miniaturise and integrate intelligence and new functionalities into conventional and new components and materials at competitive cost is particularly relevant for the implementation of ambient intelligence and is key to realise the vision of 'ambient assisted living' a concept where individuals are asisted in their daily activities at home, work or on the road and are only contacted when really necessary. The enabling factor for their realisation is systems integration technologies.

Smaller and smarter by transdisciplinarity will be the key issue in the future, systems integration the major challenge.

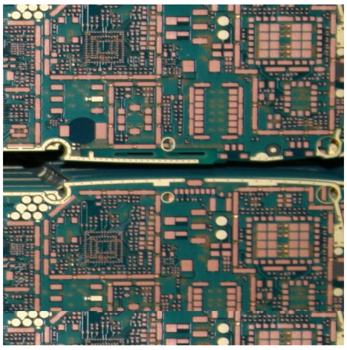
Such Smart Systems capable of mobile and autonomous diagnosis, able to sense, act and to describe and to qualify situations, able to decide or prepare decisions in an anticipative manner, with the capacity of extended self-diagnosis and their ability to communicate among themselves and with their surrounding area, to have vision and the ability to visualise will revolutionise the whole product world.

3 The Key for Product Innovation

European industry leads the world in micro-system technologies and related advanced technologies. The enhancement of the products' capabilities and services through evolving complexity, integration and interconnectivity will help ensure Europe's global competitiveness. Future innovations and market success will depend on intensifying developments and infrastructure investments.

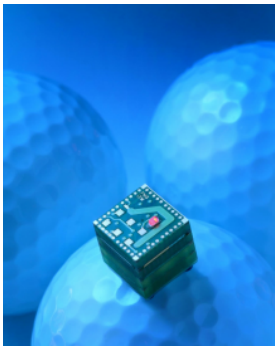
Europe has high competence and competitiveness in the various segments of micro- and nanotechnologies

The key success factor is to shorten the time between research in basic technologies and the transfer of these technologies into innovative products.



One important way to reduce time-to-market significantly is to use processes and technologies specifically developed for mass production and to reduce production costs.

New technologies will reinforce this trend. Europe has high competence and competitiveness in the various segments of micro- and nano-technologies, a diversified and internationally competitive industrial landscape over the whole span of the value chain, and a solid scientific basis.



Nevertheless, compared with the USA and Japan, the sector remains dispersed and fragmented. The use of these resources and competencies for competitive product innovation can be much improved. The Excellent RTD competencies in some of the European regions need to be exploited in innovation all over Europe and to establish or grow new research and innovation ecosystems around new emerging technology and application fields.

3.1 Product Innovation - The Challenge

New and improved products and services are providing added value to customers through higher levels of integration, simplified interfaces and lower-cost manufacturing. Future products will need to be increasingly flexible in functionality and adaptability.

These future generations of products will make new demands on integrated product design, incuding the modelling of functional as well as technological details, reliabilty and lifetime prediction methods and tools and more complex simulation and prototyping techniques. They will require multi-technological production processes and advanced product miniaturisation, will set new standards for precision require greater process reliability in order to optimise the use of resources and facilitate "intelligent" production.

The new products will necessitate an optimisation of the production and logistics environment and they will require the development of new generations of production facilities, machines and apparatuses. The introduction of new methods for the extension of life expectancy and intelligent maintenance and operational systems for industrial processes will accompany this development.

Ecologically efficient processes minimise adverse effects on health, security and the environment, optimise the use of resources and support sustainable ecological process management. Products generated this way have a clear advantage on markets which are characterised by increased ecological awareness.

While Europe becomes less attractive as a location for the low-cost production of goods at the bottom end of the added value chain, there are good prospects in the area of high-worth goods that benefit from its competitive strengths. In the area of high-tech products requiring sophisticated equipment and employees with specialised know-how, Europe has a clear competitive advantage which must be exploited and maintained. This is especially important considering that even companies whose R&D activities are still largely concentrated in Europe (more than 75% of the total) are planning to run down their establishments here.

The more systems become ubiquitous, the more system knowledge is the essential basis for cost efficiency and process reliability, technological excellence and innovative products. Products using high system knowledge need a very close interface with R&D and with customers. This characteristic will tend to require, and hence retain, the manufacture of "smart systems" in Europe in the future.

> „Relocation of R&D from Europe elsewhere brings the risk of losing the lead in the production of high-value, innovative goods",
>
> B. Klingler, KPMG, 2004

Product innovation is essential, therefore. It is essential, first, for productivity and, hence, for competitiveness and for new markets which, in their turn, will help ensure the sustainability of the investment and other efforts made. The erosion of employment in industry has to be stopped by preserving and creating new skilled jobs. Existing European strengths in know-how, educational levels, and an excellent infrastructure in research and industry must be used to generate competitive advantage through superior technology in order to successfully confront global competition.

3.2 Integration and Multi-functionality - Key Drivers for Competitiveness

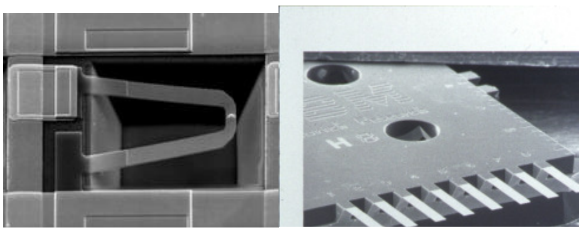
Integration, and with it multifunctionality, are likely to be the key drivers for competitiveness. Technologies in the micro and nano domain will enable this.

Competitive pressures will push the search for greater system efficiency and consistent production volumes, and will advance miniaturisation. This is the "macro-micro-nano" integration pathway

Miniaturisation: More features, less weight, handy size, less resources employment, more mobility…and low price

Innovative products benefiting from diverse micro- and nanotechnological effects have to be manageable by their users and have to operate reliably in everyday situations.

Take the keypad of a mobile phone. It should be user-friendly, the display should not be endlessly minimised and should be legible under unfavourable conditions, communication should be possible everywhere. The same basic requirements of a "human-machine-interface" and for “environment-machine interfaces” would also apply to next-generation developments such as a virtual keypad or a head-up-display reflected in glasses. The example suggests that successive miniaturisation of products with a human-machine-interface is not very probable in the near future. The component parts have to be combined in a way that allows ergonomic and



user-friendly handling.

Further progress in systems will need methods and approaches for using new developments and miniaturising technologies and integrating them to improve and enhance functions. Developments from nano- and biotechnology need to be applied, too.

Smart Systems Integration as a cross-section technology opens up the possibility to harness any physical effects - macro, micro or nano.

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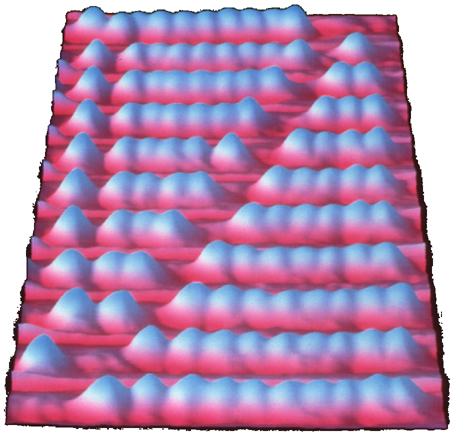


This applies for the design of new materials, such as nano-materials (CNTs) or nanopowder, as well as for the use of highly porous materials or functional surfaces. Developments in nanoelectronics, polytronics, and new achievements in high and highest frequency techniques provide vast possibilities for systems innovation using the interdisciplinary approaches of microfluidics, microanalytics, biotechnology and cognitive knowledge areas.

4 The Challenge

European industry leads the world in microsystems technologies and related advanced technologies. Highly complex and integrated products can ensure Europe’s global competitiveness.

European industry leads the world in microsystems technologies and related advanced technologies

Innovation and market success will depend on intensifying developments and infrastructure investments. New technologies such as nanotechnology will reinforce this trend. Europe has high competence and competitiveness in the various segments of micro- and nanotechnology (MNT), a diversified and internationally competitive industrial landscape over the whole span of the value chain, and a solid scientific basis. Significant public investments have been made in recent years. Compared with the USA and Japan, however, the sector is dispersed and fragmented in Europe.

Today's miniaturised systems go beyond monolithically integrated or hybrid systems and combine sensing, processing and actuator functions. The future of microsystems will consist of smart integrated systems which

- are able to sense, diagnose a situation, describe it and qualify it
- mutually address and identify each other
- are predictive
- are (semi-)autonomous , intelligent and decision-capable
- enable the product to interface, interact with the environment, with other smart systems, the systems they are embedded in and with individuals
- are able to act, perform multiple tasks and assist in different activities

Smart System Integration technologies - the enabling factor

These systems are often networked, energy-autonomous, and reliable – and miniaturised as necessary. They are becoming increasingly complex, involving different disciplines and principles. New features - like ubiquitous information, security, ease-of-use and the integration of mechanical, optical or biological functions – will be integrated using different technologies.

Legacy systems will be equipped with these same features, this "smartness", using modular design and appropriate integration technologies.

Intense international competition calls for rapid product change and shorter time to market. A broad range of diverse materials and a wide variety of technologies should be developed and integrated. Smaller and smarter by transdisciplinarity will be the key issue in the future, systems integration the major challenge. The evolution of the critical dimension of technologies into the nanometre scale together with the exploitation of completely new physical phenomena at the atomic and molecular levels has given new momentum and opened opportunities for new solutions to old and new problems in bioengineering, the environment, human-machine interfaces, etc. The integration of cognitive functions gives rise to a new concept of converging technologies (NanoBioInfoCogno). The ability to miniaturise and integrate intelligence and new functionalities, in their various forms, into conventional and new components and materials is particularly relevant for the implementation of the ambient intelligence and the ambient assisted living vision.

The **enabling factor** is smart systems integration technology.

Smart Systems Integration – a definition

Currently, there is no common definition of "systems integration". It is understood here as the progressive combining of components to merge their functional and technical characteristics into a comprehensive, interoperable system (interoperability meaning the ability to exchange and use information). Miniaturised integrated systems often use technologies from optics, mechanics, electronics, fluidics and thermo-dynamics and make use of various materials - silicon and non-silicon (e.g. polymers). Biological components are used, too. Systems integration may be based on monolithic, hybrid, multi-chip modules or other techniques spanning several scales of size in a range between nano and macro. Such a broad definition reflects industrial reality and the large potential for miniaturization to improve existing products and create completely new ones. "Smart System Integration" using integrated micro and nanosystems, put also particular emphasis on the clever interfacing, interaction and communication of the integrated smart system with its environment, with other smart objects and the system environment it is embedded in. Smart systems integration will make a significant impact on the competitiveness of entire sectors such as aeronautics, automotives, homeland security, logistics, medical equipment, process engineering, new communication media and many more.

Smart Systems Integration - Technological Challenges

Systems integration has several facets: integration of different components and functions into a small system, integration into the macrosystem, and integration into the application system. All raise new technological challenges. So far a parallel development of various technologies has been sufficient to meet customers' needs.

A major challenge is to integrate the multitude of different components, produced in very different technologies and materials. The link between application and technology has to be tightened, both in research and in product development by systems integration methodology and technology, and by adapting organisational structures.

These challenges are a unique chance for European researchers and technicians to use their technological excellence and consolidated knowledge in miniaturisation techniques, system know-how and manufacturing processes to achieve a unique selling proposition.

> Systems Integration – a progressive combining of components to merge their functional and technical characteristics into a comprehensive, integrated and interoperable system.

The systems approach calls for integrated design and manufacturing and the transdisciplinary combination of technological approaches and solutions. A set of compatible technologies and design tools will ease the combination of different modules. In the medium term, technologies can be expected that exploit unique nanometer scale phenomena integrated into microscale and macrosystems, providing integrated systems with unprecedented functionality and performance. To achieve this, numerous problems must be solved, e.g. coupling molecular level structures and devices to larger-scale platforms and devices, combining "top-down" and "bottom-up" assembly in order to create new classes of functional materials or to manufacture an integrated system, controlling the interface between biological and non-biological components in one architecture, and coupling mechanical forces across nano, micro and macro scales, including the control of fluid-state transport or optical behaviour.

Smart Systems Integration will perform the functional connection of components and subsystems on several levels:

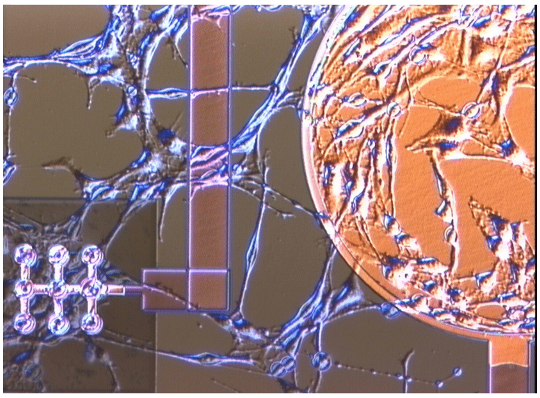
- Component level (Design, development and manufacture of miniaturised elements – “element level”)
- System level (integration into a macro system - "handling level")
- Application level (integration into the overall system - "product level")
- Process level (integration of production processes, including design, simulation, verification – “manufacturing level”)

Smart System Integration is the key for “productising” the enabling potential of technologies like nano-technology and biotechnology.

5 Europe’s Position

Increased investment in knowledge and innovation is at the heart of the Lisbon ambition. What is the European position in this area?

A comparison between the US, Japan, and the European Union shows that Europe is not behind in terms of R&D expenditure in the public sector. This applies both to publicly financed R&D activities and to R&D activities performed by public institutions.



There are about 3,300 university institutes in the European Union. The number of students at these universities is growing. In 2000 there were approx. 12.5 million, ten years earlier about 9 million. The universities employ 34 % of all researchers in Europe, with strong variation between Member States (26 % in Germany, 55 % in Spain and more than 70 % in Greece). The European Union has more science and technology graduates than the United States, but fewer scientists than the other leading technology countries. This paradox is probably due to the lower employment of young scientists in Europe, particularly in the private sector: only 50 % of European scientists work in enterprises, as against 83 % in the United States and 66 % in Japan. Universities carry out 80% of basic research in Europe.

The absolute gap between the United States and Europe in the volume of publicly performed R&D activities is relatively limited. The last decade of the 1990s saw a slight European lead.

The volume of scientific research in the EU - measured, for example, in terms of the number of publications per researcher, or per millions of euros spent on public R&D - is not below the United States. The absolute growth in internationally accepted scientific articles in Europe has been higher than in the United States. This suggests that in both scientific inputs and outputs Europe has not been lagging behind the US. Other analyses, e.g. of numbers of patents, confirm this impression, and indicate that Europe has not been lagging behind in awareness and diffusion of scientific knowledge.

> This ("British research") paradox … was elevated to a European paradox in the 1990s fairly quickly.
>
> Luc Soete, International Workshop on "Research Policy: Incentives and Institutions", Rome, 2002

The weakness in European R&D seems to be what was once termed the *British research paradox*[6]. Europe has good science and technology but is risk-averse and performs poorly in terms of innovative, market-oriented applications.

The European knowledge paradox appears to be grounded in inadequate cooperation and weak links between public and private R&D. Innovative technologies are not developed for use in (mass) production but to demonstrate proof of principle among academic colleagues. In order to use academic research results in industry it is often necessary to begin the technology development all over again.

EU Member States' research policies have generally raised the quality of public research in Europe but have not lead to specialisation of research, rather to further research duplication.

The European Research Area also comprises the private research performed in Europe, and it is precisely this research that is expected to encourage the future development of the EU towards a knowledge economy. Public policy oriented towards private research, and the link between public and private research, helps to avoid an even larger European research paradox and its consequences.

In spite of the high scientific quality of European research, the US has gained a significant advantage in many but not all scientific areas. Some of these technology areas are currently hard-fought between the *technological great powers*. In some Europe is in the lead.

The design and development, integration, manufacturing, testing and quality management of integrated and complex systems is doubtless one. Producing multi-functional micro-components needs an engineering design process aimed at transferring a technical concept from the 'idea' phase to a commercialized product. Europe has strong engineering knowledge and scientific tradition, and a competitive infrastructure in research and manufacturing. Foundries and device makers are located in all major industrialized countries.

This raises the question of how to use this winning margin for the enhancement of the European research and innovation process by

6 In the early 1960s, Britain appeared good in terms of scientific performance and technological inventions, but poor in terms of innovative, market-oriented applications

the rapid introduction of new products onto the market, the implementation of new competitive production techniques, the right organisational framework, the creation of new innovative companies, the local innovative and entrepreneurial culture, launching supporting measurements etc.

6 Exercising Options – Providing Solutions

Europe's competitive position

The European countries currently hold a good competitive position in Smart System Integration internationally. The reason for this is the huge research competence in different fields of microtechnologies, bio- and chemical technology and microfabrication, a diverse and internationally competitive industrial landscape for using the results of these along the value-added chain, and investments in public funding in recent years. This good basis and the opportunities of Smart System Integration in Europe have to be exploited and developed. This chapter illustrates some application fields for Smart System Integration. In some cases the markets for these applications are still emerging but it is clear that once a mass market begins to appear US and Far Eastern governments will spare no efforts to respond very effectively.

Leadership in Automotive

Automotive is one of the strongest industries in Europe, which is also where applications based on a combination of elements of microtechnologies first started to be industrialized, e.g. acceleration sensors, navigation systems. Smart systems were also introduced to measure and reduce concentrations of pollutants to improve air quality, support active security systems, emergency functions, and deliver comfort functions, new displays and a number of communication items. One of the most important applications with an enormous potential are driver-assistance systems. They support drivers by "preparing" decisions and, by use of cogno-abilities, make decisions absolutely reliable and earlier than a driver can alone.

Maintaining and improving mobility of citizens and goods and the associated transportation system are essential for the development and creation of wealth within any society. Road transport is the most common and accessible mode of transport for individuals as well as for commercial needs.

Important challenges for Smart Systems for automotive applications in the near future will be

- Production costs (on component and system level)
- Production technologies based on mainstream technologies
- Flexibility and scalability of systems
- Integration factor and performance (at very low cost)
- High Reliability (<1 ppm/10 years) in harsh environmental conditions (T>150°C)
- Ultra-low power for all systems

Important new fields of application for Smart Systems for automotive applications will be

Accident Prevention - Vision enhancement

With the ageing population in Europe (in 2030 about one-third of the population will be older than 60 years) vehicles must offer older drivers an opportunity to remain independent and mobile. These drivers will have a prolonged recognition and reaction time.

Older people also suffer from weak eyesight, which increases their probability of being involved in an accident.

Better lighting, infrared cameras and object recognition systems are new developments that could provide additional information to drivers, displayed on a screen. With nanotechnology there is hope for smart integrated electronic-bio-cognitive systems that could allow the vehicle to provide this image enhancement information directly into the driver's eyes.

More complex Smart Systems could even provide vision capabilities for blind people, allowing them to drive vehicles and hence be independent and mobile.

Navigation-in-Mind

Navigation systems in vehicles offer useful information to the driver, but they are user-unfriendly. The driver must type in a destination and then keep looking at a navigation console to get the navigational information.

With a Smart System, it is possible for the vehicle navigation system to provide pre-processed information to the driver's mind so that he can follow the route using his own imagination. The mind could also trigger intelligent queries to the navigation system, e.g. "What is the name of the street in which I have to turn next?" or "Is there a fast-food restaurant near the current position?".

The most important features and components of such a Smart System are:

- Radar and video sensors with a 360-degree view
- Forward-thinking car
- Accident prevention behaviour
- Zero accidents due to driver fatigue
- Autonomous braking
- Pre-crash sensing, blind spot and pedestrian detection

Driving Comfort - Dynamically moulding seats

The seats in today's vehicles are universal seats, designed to be appropriate for all kinds of body physique (high, short, fat, slim, etc.). One could imagine future seats made out of an intelligent material that moulds itself to fit the person sitting in it. Integration with biological smart systems on the driver's body could allow the seat to determine how the backbone or the neck feels in a certain configuration. Any pain or numbness could be detected by the seat and the seat could reconfigure itself to provide comfort to the driver.

Individual characterization of a vehicle

The vehicle's whole body could be made of an intelligent material composed of small configurable systems integrated to the vehicle's computer. The driver could then select a colour or pattern for his vehicle from his on-board computer and the vehicle's body would adopt the selected colour/pattern.

Such a Smart System for convenience provides

- Capability for a fully personalised car

- Efficient Human-Machine-Interface (HMI): easy to operate, operator convenience, voice and gesture control
- Mood sensitive/adapted reaction of the car (for driver and driving)
- Ensuring driver's wellbeing
- Tailored entertainment and information adapted to driver preferences
- Personalized displays, head-up-displays, flexible OLED displays, projection displays, displays covering large areas of the dashboard
- Switchable colours
- Solar cells integrated in the paintwork

Driving Behaviour - Emotion-driven Automobiles

Through system integration of the vehicle's electronic control systems and cognitive/biological smart systems within the human body, vehicles will be able to sense the driver's emotions. The engine power, response behaviour of brakes, shifting of gears could all be configured by the vehicle to fit the driver's emotions. For example, if the driver were in a hurry, the vehicle would detect it and enable faster acceleration and sharper braking, the cell phone could be switched off automatically and the music volume turned low to avoid sudden noises that could divert the driver's attention from the road.

When a driver's adrenaline or heart beat reached a level indicating lack of confidence in his own driving behaviour, then the vehicle could reconfigure engine power, gear-shifting behaviour etc. in order to encourage the driver to slow.

Driver's health / consciousness

Alcohol and drugs are frequently the cause of accidents, especially among young drivers. Through integration of the vehicle's electronic systems and body-side smart biological/cognitive systems, the vehicle could detect if the driver is able to react sufficiently fast to danger situations. If the vehicle determined that the driver is not well, drugged, drunk or had lost control of the vehicle, it could switch on driver assistance systems that would warn other drivers of danger. The survival chances of a drunk driver would be increased if the vehicle advised the driver how to behave. In extreme cases, where a severe danger was detected and the vehicle sensed the driver's inability to respond adequately, the vehicle could react on its own to avoid an accident.

Relevant features enabled by Smart Systems:

- Automated travel on special lanes may be possible, self-navigating vehicle
- Automatic parking
- Stop-and-go adaptive cruise control
- Personalisation
- Propulsion: Integration of sensors-actuators-management
- Intelligent chassis control
- x-by-wire
- resource efficiency

Vehicle Security - Vehicle theft detection information

Modern vehicles detect theft attempts and inform the police and/or the owner using long-range wireless communication technology. An almost invisible smart molecular-nano-electronic system within the vehicle could detect useful information about the thief, current location etc. and transmit it to the police or vehicle owner.

Smart Integrated Systems for automotive applications will replace existing mechanical solutions in still further ways and in a timeframe which are difficult to estimate today. New areas of technology are likely to develop, e.g. micromechatronics, nano-based intelligent catalysts or driver assistance systems.

Competitive Aerospace

The European space sector is competitive on the world market, achieving significant roles in scientific programmes, navigation and communication systems, remote sensing, launchers and space infrastructures.

Applications for governments and citizens

Space applications are increasingly becoming an integral part of major regional and global, institutional and commercial infrastructures in Europe. Governments and citizens are more and more dependent on the use of space-based systems, or are becoming increasingly aware of their enormous potential to:

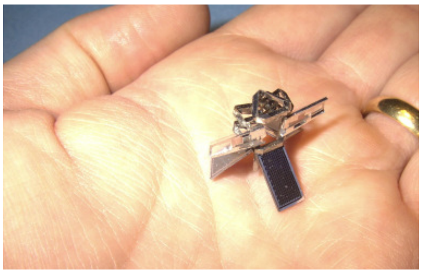
- achieve greater security for all: prevention and management of conflicts and natural disasters, meteorology, environmental security, rescue at sea
- develop the economy: navigation, communications, natural resources management, meteorology
- contribute to social progress: equal access to information, distance learning, telemedicine
- open up new spheres of knowledge and inspire future generations

Space activities today form an integral part of a political, social and economic environment which is exerting an increasingly powerful influence over the development of the technological capabilities of the European Union. Europe faces the opportunity and challenge of increasing commercial space applications, in particular with the growth in telecommunications and especially global navigation satellite systems. Smart System integration technologies comprise a wide range of innovative spacecraft concepts. The creation of EADS Astrium promises to improve European competitiveness on the world market.

Today's challenges

The benefits offered by Smart System integration technologies of reduced mass, size and power requirements, when combined with possible cost reduction (use of mass production capability), robustness and enhanced performance through high levels of integration, are clear. The technology will be especially beneficial for missions where mass is critical.

The space community is exploring the advantages of microelectronic devices, microelectromechanical systems (MEMS), and the rapidly evolving micromachining technologies, for enhancing the mission capabilities of "next-generation" micro- and nano-spacecraft.



They will permit the installation of devices which will outperform the simple systems installed on their earlier grandparents by many orders of magnitude.

Nanosatellite Concepts

The present vision is one of swarms of micro- and nano-spacecraft circling Earth, the Sun or other planets in the solar system, performing critical and highly complex tasks, interacting with each other and with the ground or space operators, and with a high degree of autonomous control capability. Advanced micro- and nano-spacecraft with distributed functionality could replace large and expensive conventional spacecraft, with the additional advantages of increased survivability and flexibility. In this scenario, very small satellites (<30 kg), alone or in constellations, have been proposed for a number of missions both in the commercial and in the scientific segment.

Very small satellites can significantly reduce mission costs as launch costs – which are roughly 30% of mission costs - are largely dependent on spacecraft mass.

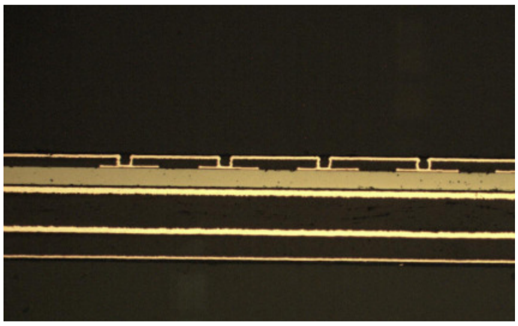
Future nano-satellites are expected to be much more advanced than today's. Future nanosatellites could use advanced smart system integration with substantial modularity ('plug and play' modules), and advanced integration could build a smart instrumentation into the structure.

Benefits from Smart Systems Integration

In the longer term, satellites will be further miniaturised. Smart System integration technology can be used to get very small nanosatellites. New technology will open up new possibilities for scaling down. Only where the physics dictate that MNT is inappropriate will the current design of spacecraft prevail.

For instance, resistors can be implemented using thick film metallisation and laser trimming. The active components like amplifiers and microcontrollers will be integrated at the die level, i.e. without the need for chip housing. The electrical connections will be wire-bonded or metallised.

The laminating of components into the carrier material will enable three-dimensionally stacked multi-layer modules.



The whole multi-layer including sensors, signal conditioning, controlling and communication, can be seen as a new smart system altogether. These micro packs will have a range of advantages such as small size, modularity, robustness, low cost, etc, which are of high value for space applications.

Multiple micro packs can be combined to operate in swarms, enabling new functionality such as resource-sharing or measurement functions. Data fusion will allow handling of the whole as a common system. Reliability and repair management will be easy: faulty systems can have their functionality replaced by healthy ones.

Smart System integration technologies will ensure safe and stable operation during the whole mission. They will ensure European competitiveness on the world market for space applications.

In-Time Logistics & Retailing

Transport and logistics play a growing role in the development of modern economic systems. They are the backbone of sustainable economic growth.

Their importance varies according to the location of an activity in the supply chain and the bulkiness of products.

Moreover the trade and retailing industry has been undergoing fundamental transformations in recent years. The changing economic and political circumstances as well as the continuously shifting of expectations of consumers require flexibility and innovative power. A permanent task for these businesses in this context is the continuous optimization of processes.

Europe faces complex challenges in logistics:

- High availability of products
- Improved quality assurance
- Efficient inventory and warehouse management
- Low warehousing and transportation costs
- Quick and precise control of the supply chain
- Permanent inventory

More varied delivery patterns will result in a mixture of different stock-holding strategies.

Intelligent solutions are required.

A new application for Smart System integration, but in Europe one regarded as having a high potential to become a mass market, are smart labels used for logistics and retailing. The basic approach is to attach RFID chips to loading equipment, boxes, or directly to goods, in order to track, trace, and monitor the commodity flow via stationary readers. Expected benefits for strengthening European competitiveness in this sector are reduction of logistic costs and better support for up-to-date logistic concepts like supply chain management and efficient consumer response.

Chipless and read-only RFID systems have been used for years in numerous low-level applications like animal tracking, theft protection, and access control. Really ‘smart’ labels, i.e. read-write systems with a chip of their own and possibly sensors and a battery, are still under development.

Challenges and opportunities for such systems are:

- Use of Smart System integration to achieve a smart combination of systems.

  Aim: clever system integration improves cost efficiency of the design process, the production process and the maintenance of the complete system

  Approach: Each component of a smart RFID tag, involving several process steps (chip, antenna, inlay, etc), is designed so that the production of the entire tag becomes much more cost-efficient than at present.

- Use of **Smart** System integration to achieve smartness by combining different systems.

  Aim: combining a set of systems creates a complete system which is predictive, self-learning, error-tolerant, etc.

  Approach: by combining tags, readers, communication systems, and new applications in back-end and front-end computers, a holistic RFID system can be developed that provides a self-correcting, real-time supply chain for retail shops

- Use of **Smart System i**ntegration to handle a combination of Smart Systems.

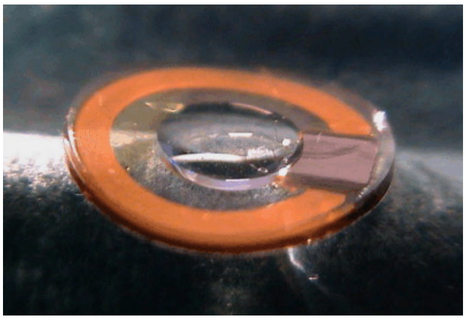
  Aim: Systems that in themselves are already predictive, self-learning, error-tolerant, etc. are combined to improve their "smart" characteristics

  Approach: A new type of RFID tag would combine not only data (i.e. EPC data) but also sensors and actuators that enable immediate action within the self correcting real-time supply chain without back-end connection at all locations

There is huge potential for European industries to innovate in components, structures and process organisation.

Future-proof with Life Science

Ageing is increasingly a challenge for Europe. It is estimated that by 2050 the number of people over 60 will have doubled to 40% of the total population (60% of the working age population), Over the next few decades, the "baby boomers", the largest generation, born in the 1950s and 1960s, will start to retire. The situation will be exacerbated by the very different expectations and life expectancy of their parents and grandparents. The future structure of the health market depends critically on the national health-care regulatory environment and the preference structures of individuals.



> Ageing is increasingly becoming one of the most salient social, economic and demographic phenomena of the near future. In Europe the problem will be acute.

The Ego Patient

The currently most realistical scenario is the "Ego Patient" scenario, which is characterised by high private expenditure for health products and services, provoked by a growing market with lots of innovative offerings. The combination of a market economy and personal responsibility in health care provide -

together with voluntary expenditures for health - a higher-than-average growth potential (consumer market). Innovative health products will profit from this development.

Life Sciences have become an interesting and economically significant field in Europe. The elderly will need healthcare, pensions, housing, and community care - and on a greater scale than ever. **Smart care, health care, self-therapy** and **self-diagnosis** as well as **ambient assisted living** are the drivers for use of smart systems in this application field. There is substantial interest in Smart System integration for medical applications which hold the promise of revolutionizing the way people receive treatment. Smart System technology can act as an "enabling technology" which makes specific biotechnological and (bio)-medical applications possible.

One fits all?

The number of medical and life science problems that could be addressed by Smart Systems is huge. However, in the vast world of medicine and life science the challenge is always to develop products that perform their

task with exceptional reproducibility. No single device can possibly cover the spectrum of applications. Platform technologies with a clear potential for differentiation according to the application can be successful. Smart System integration will provide this opportunity.

Smart System integration technology holds a great deal of promise for elaborate miniaturised fluidic systems including possibilities for data processing in an elegantly simple way.

For example, the use of DNA micro-arrays as highly parallel tools for decoding the functional significance of billions of bases of genetic code has led to the use of semiconductor technologies for patterning these parallel devices. Another approach, involving directly controlling surface chemical reactions using an active semiconductor device, has a great number of potential applications.

These possible applications will provide long-anticipated improvements in

- Preventive/predictive healthcare
- More personalised healthcare
- Earlier diagnosis and treatment of cancer, Alzheimers disease, diabetes and other widespread diseases
- Detection and avoidance of epidemic/pandemic

- Advancement of peoples well being and well feeling

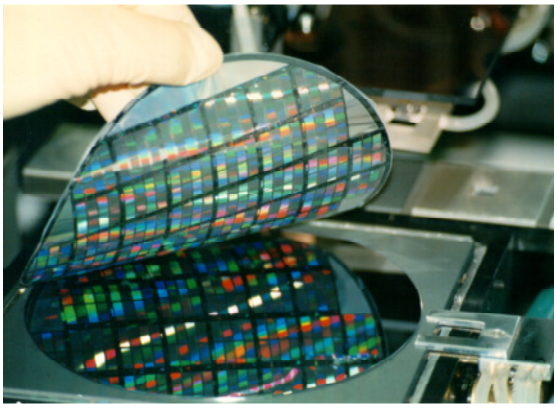
To be successful, Smart Medical&BioSystems must meet the requirements of a demanding market. The more complex the device (e.g., “sample-to-answer” concepts), the more challenging the specifications will be.

Materials – a critical factor

There are critical challenges in the area of materials. For example, materials developed for the microelectronics industry were never intended for medical/biological applications. Many materials used in semiconductors or their packaging are unsuitable for biological applications. Changes in manufacturing techniques will be needed to succeed. Biological samples can be highly sensitive to surface chemistry, and most biological systems are optimized for low protein binding and low background fluorescence applications. Semiconductor devices have never performed well in warm aqueous solutions containing large amounts of chloride ions - the one common denominator of most biological fluids. Hybrid devices made with combinations of materials can solve many of these issues. However, multi-material approaches also present their own technological hurdles. Smart System integration technologies can address these challenges.

Silicon, though versatile, cannot possibly meet the technical requirements for every type of bio & medical application. The microfabrication of polymers has economic advantages and is an attractive alternative route for developing Smart Medical&BioSystems.

Using hybrid silicon devices for non-volatile memory applications such as serial number incorporation may allow existing technologies to leverage hybrid multi-material bio-nanotechnology in familiar ways. An example are cellphone-like miniaturized devices that can rapidly scan, sequence, and identify signatures of DNA, proteins, and infectious agents; their development is likely to be driven by the combined demand of personalized diagnostics, forensics, and defence markets. Implantable Smart Systems for real-time diagnostic sensing and biological augmentation of endocrine, neural, and visual functions are entering the realm of the possible. Such ambitious applications are likely to be driven by Smart Systems integration technologies.



Materials expertise will be critical for success. Whether biology will begin to follow Moore's Law will depend on whether silicon can deliver on its promise of more rapid, more parallel analysis with the ability to interrogate increasingly smaller amounts of biological sample without adding to the tremendous amount of "noise" that is biological variability.

New manufacturing procedures have allowed miniaturized, mechanical construction elements to be linked with electronic components in recent years. The extreme miniaturization and the reduced energy consumption enable wide-spread application. The miniaturization of surgical instruments took minimal invasive surgery to a higher level.

Biotechnological application will also benefit from Smart Systems. Applications in analytics and diagnostics play the major role here, like the determination of nucleic acids, peptides, proteins, biochemical or cellular components. Micro detection and microfluidics are perhaps the most important disciplines in life sciences, since usually “weak” signals of biological reactions have to be detected in liquid systems.

Smart Systems technology will powerfully influence the upcoming era of individualized medicine. It will have a considerable impact on public health systems in Europe, which are currently in a process of change due to obsolescence.

Smart Systems technology in life sciences is a recent application field and market penetration in Europe is at its beginning. New products and devices are expected to emerge soon, e.g. integrated smart systems for lab-automation of various biological, medical and pharmaceutical analyses, technical platforms for cell analysis and cell handling, micro cultivation systems, stand-alone devices for molecular diagnostics or biodetection systems for contaminated sites.

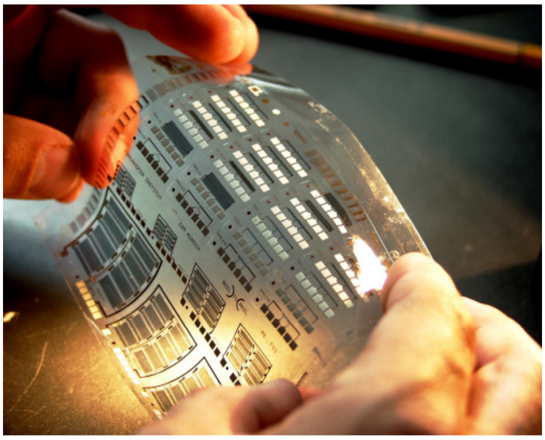
SMEs will have opportunities to create their individual portfolios of core technologies to use Smart Systems integration for new health-related products. Earrings can check stress via the body’s blood volume pulse. A running bra can measure respiration rate and muscle tension. A shoe can track skin conductivity, another sign of stress. A glove can double as a computer text editor. A ring can silently record the wearer’s vital signs, contacting a physician by computer if necessary. Because the user of such products is not normally able to interpret the complex data, the integration of a “sample-to-answer” concept as a human interface will become an important necessity.

Interdisciplinary Approach

An interdisciplinary approach means links between disciplines, e.g. between material sciences, microsystems and RF techniques for a new class of implantable sensor to detect blood pressure, flow rate and other key information from deep within the body and able to wirelessly transmit the collected information to equipment located outside the body. A similar Smart system could be used to monitor the pressure within an aortic aneurysm and in the treatment of congestive heart failure.

Flexible with Polytronics

In addition to “traditional” approaches for silicon-based applications, and increasingly in combination with them, polymer electronics today already covers the development and application of active and passive electronic and optical devices, based on organic and/or inorganic materials and their complex system integration.



The increasing interest of the industry can be seen primarily in the advantages of polymers in comparison with conventional semiconductors, i.e. their mechanical flexibility, simple, economical and extensive workability by the use of solvent processes (spin coating, spraying, printing, etc.) and the possibility to optimize their characteristics by chemical modifications.

Polytronics opens up new innovative possibilities that connect applications like transistors, LEDs, detectors, sensors, actuators and displays with features like flexibility, free design and novel combinations of functionality. The mid-term goal is to integrate a variety of electronic functions, such as sensing, computing and information storage, into a wide range of materials, including consumer packaging, and to enable all these to communicate via low-cost radio frequency technology.

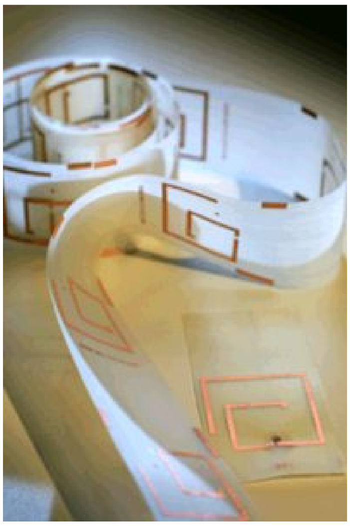
Polymer-based electronic systems will play a key role. In developing these new technologies, European researchers and engineers can aim to apply existing system and circuit-design expertise gained from their work on advanced silicon systems to new materials and devices that can be manufactured at substantially lower cost.

In principle two fundamental trends in polytronics can be observed. The first is the development of active suitable polymer electronics for simple products ("disposable electronics") which today due to cost limitations can only partly be covered by silicon. For this high-volume printing technologies suitable for mass applications are being developed.

The second trend in polymer components can be seen in the manufacture of hybrid microsystems. Examples include: active smart cards, which contain polymer batteries and displays, e.g. for showing account balance; smart labels with integrated temperature sensors and self-sufficient power supply for monitoring the cold chain in the food industry; disposables for medical applications, and electronic paper and electronic books

This technology can be expected to lend itself to many different applications. The simple printing process for manufacturing means that SMEs should have many opportunities for adopting the technology to create innovative products responding flexibly and fast to customer demand. The creation of lucrative niche markets is possible.

Mass market applications are also in view. Logistic service providers and manufacturers around the world are eager to see the development of low-cost RFID chips and smart tags to replace bar codes. One possible application for the technology would be to print RFID chips directly onto consumer packaging. Manufacturers of medical devices, e.g. for self-diagnosis or self-therapy, may also be able to use the technology to provide even more complex smart active systems in the form of low-cost disposable devices.



A polymer-based RFID chip functions just as a silicon RFID chip does, but polymer-based chips are cheaper to produce. An expensive semiconductor fabrication facility with clean rooms is not necessary. The replication technologies are very similar to (ink-)printing technologies, and a polymer-based chip, being made of plastic, is more flexible and thinner than a silicon chip, which is rigid.

Components based on a basic organic polymeric semiconductor technology will be applicable in many advanced applications related to hospital-patient monitoring and tracking, supply chain management and large flat-panel displays. They can replace more expensive silicon solutions but also enable completely new applications.

Smart Systems based on polytronics can address multiple industry segments. Within the healthcare industry, applications will include patient monitoring, asset tracking, inventory control of pharmaceuticals and medical equipment, and other forms of information management. Other targeted industry segments will include the semiconductor, paper, chemicals and computer industries.

Prospects in „Unforgettable“Systems

All Smart Systems need efficient memory. They need to be able to diagnose a situation, describe it and qualify it, mutually address and identify each other, to be predictive and decision-capable, and enable the product where they are within to interact with the environment. The ability of storage the acquired data, information is undoubtedly a basic requirement of Smart Systems.

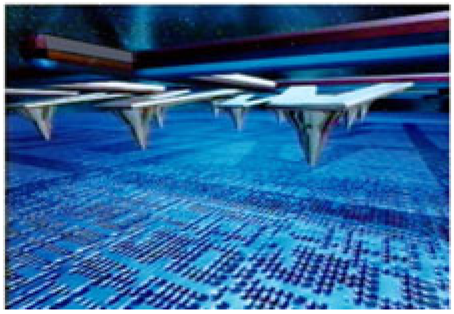
Storage and memory technologies will have to satisfy at least the following requirements

- Conveniently store huge quantities of information, often with stringent requirements on data density (memory size), security and price
- Process this information to allow practical and efficient handling
- Transfer the data at high speed

With the growing usage of networking systems, more and more data will flow from complex networks of sensors and wired or wireless components, for health, process automation, workflow, traffic...

A second key challenge is the capability to handle such data flows while preserving security, privacy and accessibility. This will require the combination of all available innovations in memory technologies and radical evolutions in the treatment of information at all levels based on integrated smart systems (sensor, processing, collecting, back up...). The “no data loss” criterion will be the norm.

This huge flow of data will be used to improve work productivity, health monitoring, safety applications, logistics, education...

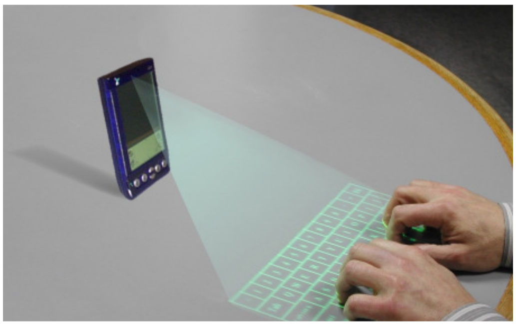


Data storage appears to be central to all smart system applications. Enhanced memory performance could be the driving force leading to better system behaviour and performance. A memory is always a strategic part within a however smart system. The race for increased performance requires the use and improvement of diverse and wide areas of technological know-how in mechanics, semiconductors, magnetism, and optics.

"... a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility".
V. Bush, As We May Think, 1945

Products based on smart systems will satisfy consumer needs, but also more targeted applications such as process automation, security issues, applications for mobility, space missions, health monitoring, with the continuous recording of parameters. Huge amounts of information will need to be stored, all accessible in several manners. The size of the necessary memory will be in the TBits range, and new ways to handle the complexity of the stored information have to be designed.

Many of the exciting visions of progress building upon advances in Smart Systems integration will require progress in mass data storage technologies.



Mobile or `un-tethered' (smart) systems are on the way to replace the PC as the dominant memory-using electronic platform. Examples of such un-tethered devices are numerous and include laptop computers and personal digital assistants as well as digital video and mobile telephones.

The change of dominant platform, from `tethered' PC to hundreds of applications of 'un-tethered' devices, will have to be considered in R&D-roadmaps of future applications of memory technologies.

The change in dominant electronic platform is not the only reason to look at future storage technologies. The need for storage capacity has driven the areal density at which data is stored ever higher. This is primarily due to the now well-known superparamagnetic limit, and many novel approaches are being considered for overcoming it.

It will probably not be long before an individual bit on the surface of a disk is of molecular or atomic size.

There are reasonable prospects for nanoscale, and even molecular or atomic, surface storage as alternative approaches (to conventional optical, magnetic and solid state storage techniques) and using new materials and technologies of Smart Systems integration.

7 Objectives of the European Technology Platform on Smart Systems Integration

Developments towards realising smart systems integration will continue to need significant investments in human resources, research infrastructure, equipment, and knowledge and would benefit a strategic approach, a common vision and common research agenda. A European Technology Platform is considered to be the preferred instrument to put foreward such a strategic approach. A primary objective of such a European Technology Platform (ETP) therefore will be to mobilise a sustainable critical mass in the European Research Area (ERA) which will concentrate common structured efforts in the seminal technological field of Smart System integration.

The European Technology Platform on Smart Systems integration must address the following issues in order to obtain significant structural improvements:

- Understanding the systems-centric view of tomorrow's world
- Harnessing, exploiting and utilising current capabilities (technical and intellectual)
- Enhancing European competence in knowledge management and metadata management
- Establishing scenarios for current product/technology developments (hard- and software) as well as for future applications.
- Translate the Smart Systems Integration vision and product/technology scenarios into common Research Agendas
- New integration technologies, new materials, new packaging technologies for system integration, testing, design, etc. as a basis for new products and production methods
- Micro- and nanotechnology (MNT) manufacturing issues for European industry: design and foundry concepts for microsystems as well as nano-particle processes and back-end or packaging issues including equipment for MNT manufacturing, metrology and characterisation
- Shared "open" access to excellent but dispersed research infrastructures: Europe-wide strategy for managing the distributed research infrastructure
- Standardisation of processes, interfaces and tools.
- Implementation of Intellectual Properties Rights Protection
- Development of multi-disciplinary human resources, skills and flexible mobility in Europe
- Reduction of barriers between new and old EU Member States and candidate countries and improved co-ordination, communication and information
- Research and Innovation ecosystems for emerging smart integrated systems and/or smart system integration technologies.
- Greater public awareness, acceptance and buy-in

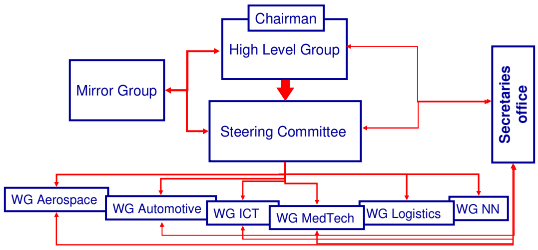
- Preparedness against disruptive technological changes and promotion of competition and commercialisation of research results considering the role of SMEs in the supply chain

Europe has developed strong resources in the microsystems and smart system integration-sector over the last decade – through private and public initiative – and an encouraging position for building a competitive European innovation cluster has been achieved. Further progress requires a change in paradigm in terms of aggregating the heterogeneous industry and research community and of developing new instruments for interdisciplinary and for applied R&D activities as well as new models and formats of policy support.

The European Technology Platform on Smart System Integration is a tool to support these efforts in an effective manner.

8 Structure and Governance of the Smart System Platform

A number of permanent expert working groups as the operational element will be created after the launch of the platform.



Platform structure

Each working group will be led by an industry representative and will involve representatives of public research, universities, public authorities and scientific, industrial and civic associations which are deeply involved in the targeted field of the respective working group. Each group should develop a long-term vision and implement a corresponding roadmap.

In addition to the working groups, a steering committee will be formed to deal with all the cross-sectional issues related to framework conditions for research targets and directions. Such cross-sectional issues include securing the necessary financial and human resources, initiating development of adequate education and training structures as well as issues of standardisation. A specific task will deal with strategies, methodologies and measures for faster and more effective implementation of research results and technology advances into product applications, process modernisation and organisational innovation. This group will also provide an operational link to the European Commission, other public authorities and to the working groups, with the aim of establishing an innovation framework in Smart System integration for companies in Europe.

Above this operational structure, a High Level Group (HLG) will guide the overall strategic development of the Technology Platform. The HLG will provide the link to the European Commission and to other thematically related European Technology Platforms. The chairman of the HLG will be a senior industry representative. The work of the platform will be supported by a dedicated secretariat. The main tasks of the HLG will be:

- representation of the Technology Platform to the public and to policy makers
- initiation, restructuring and termination of working groups (and other special task groups, if necessary)
- development and updating of the Technology Platform's overall mission and long-term strategic targets
- initiation of partnerships with other Technology Platforms, public and/or private funding programmes or bodies, public authorities or other relevant partners, and the definition of goals and conditions of such partnerships

The tasks of the Working Groups will be:

- development of a long-term vision, of innovation targets and a strategic roadmap, for merging these efforts into a strategic research agenda to support the development and application of Smart System integration in Europe.

- development of the platform into a key scientific, industrial and political reference
- definition, preparation, acquisition, evaluation, benchmarking, guiding and launching of specific research programmes, innovation and other-supporting activities and projects
- publicity at European as well as at international level
- preparation and internal and external dissemination of activity reports

A Mirror Group will be set up composed of high-level representatives of the European Commission and EU Member States, intermedians, and politicians.

9 Disclaimer

This document has been compiled from many contributions from many individuals in industry, academia and elsewhere who have taken part in this initiative to set up a European Technology Platform on Smart System Integration. The author has made every effort to include all views and to verify all figures and statements.

The paper is intended to serve as an input for a more intensive discussion. It should provide the rationale for and support the mobilisation process in politics, research and business that is needed to implement a coordinated initiative which includes all stakeholders.