

# A new roadmap

**Earlier this year, a new long-term Technology Investment Roadmap was drawn for the Dutch high-tech industry. The roadmap provides an overview of trends in the fields of systems technology, component technology and manufacturing technology. Succeeding the 2004 Precision Technology Roadmap, which primarily focused on technology ('precise to within a nanometer, quick to within a micrometer'), the 2010 roadmap has a more strategic approach and is of particular interest to various suppliers in the high-tech industry. Mikroniek included a preview of this roadmap in the February issue, which will now be presented in more detail. Later this year, Berenschot, DSPE and TNO Science and Industry will organise a Technology Investment Roadmap day for interested companies.**

The call for a long-term Technology Investment Roadmap came from Dutch original equipment manufacturers (OEMs). The objective was to analyse their technological needs and vision in the areas of nano-electronics, embedded systems and mechatronics, to explore directions for technological solutions, to identify the various roles in the supply chains and to describe the interactions between the relevant parties, including OEMs, their supply chains, research institutes and visionaries.

## World-class

In recent years, Dutch OEMs have demonstrated that the Netherlands plays a world-class role in high-tech systems, thanks to the support of a competent supply chain. This supply chain's added value, however, could increase if more "ownership" were taken in designing and sustaining functional modules for these OEMs. As the number of OEMs is small, the supply chain's dependency and vulnerability has to be reduced by growth, either by attracting foreign OEMs or by forming new Dutch OEMs in new markets. Besides, ongoing innovation is required in systems, component and manufacturing technologies. The roadmap aims to offer new insights and tools to suppliers for exploiting foreign markets, developing new application areas and applying new-generation manufacturing

technologies. The markets that are addressed include health care, energy & power, ICT, lifestyle & leisure, and transport, logistics & security.

## Systems engineering

The roadmap is primarily intended for Dutch high-tech suppliers regarded as 'masters of manufacturing'. They must continue to anticipate the ever dominant trend of functional outsourcing at a high bill of materials level by today's OEMs. The building blocks that are given to suppliers in this way are characterised by their low volume, high mix and high complexity – in other words, small numbers, multiple product versions and advanced technology. To create clarity in such a complex situation,

### Technology Investment Roadmap Day

On 23 November, Berenschot, DSPE and TNO Science and Industry will host a Technology Investment Roadmap day in Eindhoven, the Netherlands, for suppliers who want to explore the future of the high-tech industry in relation to technologies and markets. For a detailed programme, see page 63.

# - II. Overview



The new roadmap covers a wide variety of application areas.

## Roadmap partners

The new roadmap for the high-tech industry in the Netherlands was drawn by Berenschot at the behest of Point-One, Brainport Industries and DSPE.

Point-One is an open association of and for high-tech companies and knowledge institutes in the Netherlands working on research and development in nano-electronics, embedded systems and mechatronics. For Point-One, the roadmap is a means of enabling High-tech Systems & Materials, a key field that includes the above-mentioned domains, to grow from a current turnover of €20 billion to €30 billion in four years.

Brainport Industries is an initiative of Brainport, the innovation network of the Southeast Netherlands top technology region. The aim of this initiative is to enhance the industrial

infrastructure in the region on the basis of the philosophy of open supply chain collaboration.

The Dutch Society for Precision Engineering (DSPE) is a professional community and interest group for precision engineers in the Netherlands. One of its ambitions is the promotion of 'Dutch precision'.

With its head office in Utrecht, Berenschot is an independent management consultancy firm with more than 500 employees in the Benelux region. Berenschot's competences include organisational development & management, research & benchmarking, and strategy & marketing.

[www.point-one.nl](http://www.point-one.nl)  
[www.dspe.nl](http://www.dspe.nl)

[www.brainport.nl](http://www.brainport.nl)  
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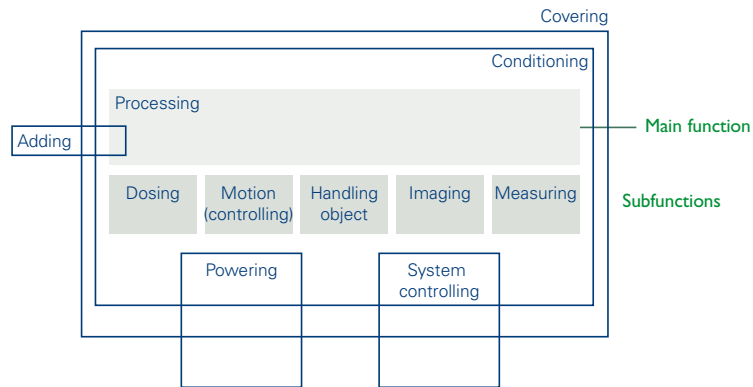


Figure 1. A systems view of high-tech product development.

the roadmap designates generic building blocks that can be identified in dozens of different systems for various application domains. Figure 1 provides an overview of this systems view. By thinking about building blocks in this way, suppliers can utilise their specific expertise in different areas of application.

Relevant trends concerning these building blocks include the complexity of motion control, increasing speed and accuracy of positioning, sustainability and low power, wireless powering, non-contact measurement, and applications in extreme vacuum.

**Components**

This systems approach was also a key element in the previous roadmap and now prevails in Dutch industry. In addition to systems, there is currently also a strong focus on components. A dominant trend is miniaturisation (for micro-electronics this is reflected by Moore’s law): more functionality in the same volume, and an increased functionality in one component or module. For example, more and more sensors and actuators are built as MEMS (Micro Electro Mechanical Systems). To add to the complexity, 2D structures are being replaced by 3D structures. Nanotechnology introduces new functionality, such as nanomotors, nano-antennas and nano memory tubes, and additional functionality can also be obtained by merging technologies, for example electronics with mechanics, fluidics or photonics.

**New manufacturing technologies**

Naturally, everything that is new in terms of systems and components must be manufacturable and affordable. In the Netherlands, however, knowledge of manufacturing technology is at risk of disappearing at a time when exciting developments in manufacturing are taking place, e.g. the emergence of deposition technologies such as Atomic Layer Deposition, electroforming and metal printing. With some sixty different manufacturing technologies available, the careful selection of a processing strategy is of crucial importance. Manufacturing components increasingly requires a combination of removal, deposition, cleaning and inspection technologies. New materials, such as ceramics, engineering plastics, composites and biomaterials, demand that existing processes are adapted or new manufacturing processes developed.

Besides general trends (high speed, low cost, low power, less waste), specific trends can also be discerned; see Table 1.

Table 1. Specific trends in manufacturing.

- Breakthroughs in deposition technologies, offering more design freedom and making smaller series affordable, for example, dosing, printing and jetting of metals.
- Deposition technologies for single products and spare parts.
- Serial processing (milling-measuring-polishing) with minimal object handling.
- Hybrid processing (for example, electro-chemical machining and milling).
- Handling of small and soft (non-stiff) objects.
- Cleanliness for vacuum applications of components.
- Increasing precision (also in 3D) following the so-called Taniguchi curves that relate technology with precision.
- Combined processing and in-line monitoring for enhanced precision and throughput.
- Contact-free measurement because of decreasing sizes of workpieces and components.
- New processes in the field of connection technology for the placement and connection of precision components.
- Increasing computer control of processes.

**Supply chain development**

Organisational changes have been introduced in response to the aforementioned technological trends. OEMs are outsourcing at a high bill of materials level and increasingly involve their suppliers in the early stages of product design, demanding the utmost of their creativity and resources. Along these two lines (involvement with the bill of materials and involvement in the product creation process) suppliers can specialise as either system innovators, system integrators, product specialists or process specialists, each with their corresponding competences; see Figure 2.

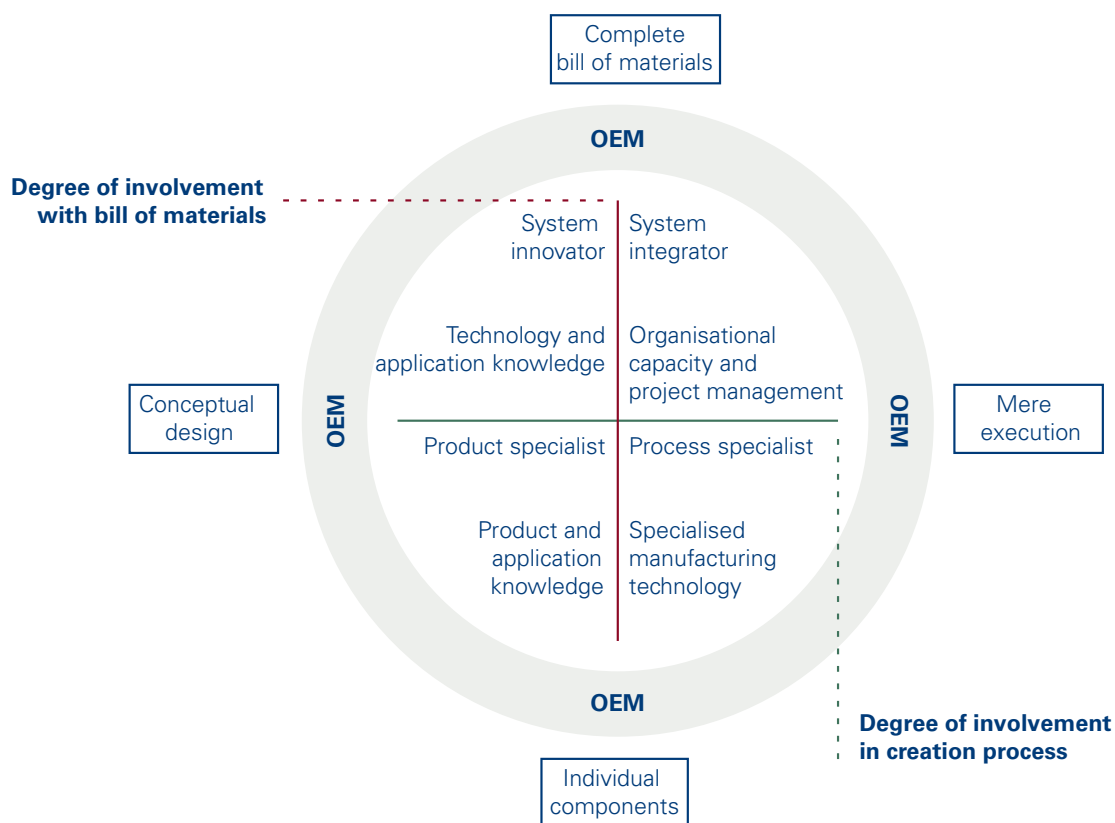


Figure 2. Specialisation of high-tech suppliers according to their degree of involvement with the bill of materials (from individual components to (sub)systems) and the product creation process (from mere execution to conceptual design).

### Opportunities in new end-markets

Based on the above outline, numerous opportunities for high-tech system developments and promising markets can be identified, including:

- health care applications based on optical devices and fluidics beyond the traditional field of the so-called big irons (scanners);
- development of manufacturing technologies for living materials;
- robotics (for reasons of human safety or cost reduction);
- micro-reactor technology for producing minute quantities of specialty chemicals;
- 3D deposition technologies.

### In conclusion

The long-term Technology Investment Roadmap with its overview of systems, component and manufacturing technologies is meant as an “opening offer” for the high-tech eco-system. This eco-system includes high-tech supply chains, universities and other knowledge institutes, and parties that may act as supply chain and eco-system directors. The roadmap outlines the opportunities, and the insights presented may help to promote collaborations and achieve technological breakthroughs. A proposal for a collaborative development programme for manufacturing technologies is presented as an initial example; subjects include metal dosing, 3D electroforming, contactless and dry processing methods, new hybrid technologies, computer-aided technologies, low-volume connection and assembly systems, in-line and 3D freeform measurement.

There is work to be done for Dutch high-tech suppliers.