

SATW Technology Outlook

Condensed version



Switzerland has a significant industrial sector today, which contributes almost 20 percent to the country's gross domestic product. If we look at the next five to ten years, however, new technologies and processes are already emerging, the mastery of which will be fundamental to the success of Swiss industry.

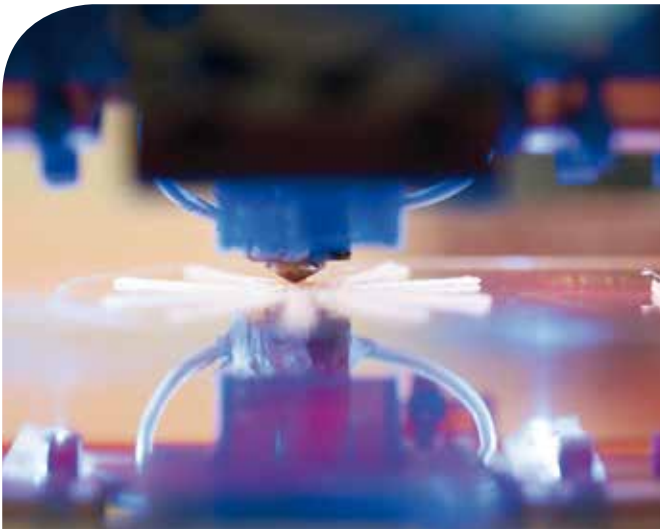
SATW has compiled the Technology Outlook which takes up these **technological challenges** and shows their relevance to Swiss Industry.

For the Technology Outlook, experts from an academic and industrial background analysed comparable reports from major economic powers and compared international trends

in the Swiss export industry. This revealed that certain key technologies will be crucial for the success of all sectors. These technologies have been illuminated with the help of industry representatives in a context where they should enable the breakthrough of essential innovations. **Clear recommendations for decision-makers in the political and economic world conclude the outlook.**

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Schweizerische Akademie der Technischen Wissenschaften
Académie suisse des sciences techniques
Accademia svizzera delle scienze tecniche
Swiss Academy of Engineering Sciences



The four most important Swiss export sectors will need to tackle fundamental challenges.

An important criterion for assessing technological trends is their relevance to society. A careful analysis of the Swiss industrial landscape shows that the four most important Swiss export sectors are fundamentally well positioned, but additional efforts are also necessary:

- **Companies in the chemical and pharmaceutical industry** must assert themselves in a business environment which is undergoing substantial upheaval. This is compounded by the fact that costs will increase due to additional regulation in the innovation process. Trends in synthetic biology and biotechnology, in the precisely targeted use of active substances, in advanced chemicals for the intermediate storage of energy and in the development of innovative packaging and materials must not be missed. Innovation capability is and will remain the decisive factor for commercial success.
- In the area of the **machine industry and precision instruments**, additive manufacturing methods (“3D printing”) and the associated material development are of vital importance. In addition, precision optical methods for machining and measuring surfaces must be mastered. It is also expected that the production chain will become fully digitized in future and all devices will be networked. Innovations in production processes, automation and quality in particular are considered central components for maintaining competitiveness.
- Despite worldwide export growth, the Swiss **watch industry** is coming under pressure, due to regulatory restrictions and prohibitions and the development of the iWatch, for example. Here too, new materials must be optimally used and innovative, high-precision material handling and manufacturing processes must be mastered.
- An important aspect for the **medtech industry** is that health care is currently undergoing a fundamental transformation from the previous primarily curative approach to a preventive approach. A strong interdisciplinary orientation and increased use of modern information technologies characterise the relevant key technologies. These include robot-assisted surgery, the combination of diagnostics and therapeutic microsystems, as well as laboratory tests directly at the patient’s bed.



Four key technologies will be critical to the success of all industries.

Information and communication technologies (ICT) will pervade all areas of life even more strongly in future and be drivers of ground-breaking developments. Key technologies such as **cloud computing** and the “**Internet of Things**” in combination with the acquisition and analysis of large quantities of data (**Big Data Analytics**) will enable people, objects, services and systems to interact seamlessly. In order to satisfy the trend towards increasing **urbanisation** and **intelligent energy management** in the energy and transport sector, the energy and transport networks must be fundamentally restructured. ICT will enable the transition to **networked, intelligent systems**, which requires increased monitoring of **critical infrastructures - including** against cyber attacks. **Digital manufacturing (Industry 4.0)** will result in the complete penetration of industry, products and services with software and the interconnection of all devices. ICT will drive the transformation from curative to **preventive, participatory medicine, as real-time monitoring, long-term acquisition** and management of physiological data will be possible. Here too, ICT are required to ensure data protection with innovative technologies.

New processing technologies such as **additive manufacturing (“3D printing”)** will bring the **development of new materials** with them. Previously non-producible structures and geometries and the production of individual components and small runs will become possible. These include improved surgical implants and “materials” for regenerative medicine. New materials with innovative characteristics

will change manufacturing and finishing processes, and open up new fields of application: **smart materials**, which specifically react to changes in environment and load, and can therefore be used as sensors; **biomaterials**, which fulfil a biological function without being damaged by the environment, and **nanoparticles**, which due to their relatively large surface have very different characteristics to macroscopic bodies of the same material.

The development of **advanced sensors and actuators** is essential for the monitoring and control of future electricity and transport networks. In medical technology, user-friendly, low-impact and self-powered sensor systems will allow constant monitoring of ill people at home, enable personalisation of treatment and lead to the development of neural and sensory implants.

In **robotics**, three trends can be identified. Conventional rigid robots will be transformed into **mechanically flexible machines** for assembly applications. The development of **simple robot systems** is the prerequisite for use in the consumer area, for supporting people in need and for increased efficiency and personalisation of physiotherapy. In medical technology, **micro-robots** will be able to replace today’s surgical robots.

Recommendations

Industry-oriented research must be promoted more vigorously.

Applied research, i.e. research between long-term basic research and short-term product development, is overly neglected in Switzerland. Although this gap has already been identified, existing efforts must be further reinforced. This can be done by changing the orientation of the Commission for Technology and Innovation (CTI) or through additional new funding models of the public-private partnership type. For these research activities in the pre-competitive environment, access to funding for industry, especially SMEs, should in particular be improved.

Swiss research facilities and industry must jointly promote material and process development for new manufacturing techniques. A national manufacturing initiative is required.

The mastery of production technologies is one of the core competencies in high-wage countries for maintaining the competitiveness of industry. This requires intensive cooperation between academic research and industry. Cooperation projects, technology centres with pilot systems for pre-competitive development and the provision of resources for the relevant training must be implemented within the scope of a consortium.

The development of cyber security and data protection requires an integrated approach.

Information and communication technologies will further pervade everyday life, which will also increasingly affect the control of sensitive systems which are vital for society. These include the energy and transport sector and the medical sector. Authorities and organisations entrusted with specific tasks must give the highest priority to Internet security. Developments in the area of information and communication technologies require that the legal framework be redesigned and research be reinforced in order to ensure data security.


The development of appropriate framework conditions for business must be consciously advanced.

Dynamic business development requires appropriate framework conditions. Attractive conditions must be in place so that investors and venture capitalists are willing to finance innovations at an early stage. At the same time, regulatory authorities should see themselves as partners of companies and develop efficient regulatory processes. To preserve the strength of the location of Switzerland, not only is an outstanding training in scientific and technical subjects required, education is also needed in basic values such as respect and willingness to cooperate as well as a dynamic, non-discriminatory workplace.

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