Swedish Technology Foresight 2004
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Title	Teknisk Framsyn
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Sponsors:	Industrifonden
	The Royal Swedish Academy of Sciences & Engineering - **IVA**
	The Knowledge Foundation - **KK-stiftelsen**
	Labour Organization/Union - **LO**
	The Swedish Business Development Agency - **NUTEK**
	The Confederation of Swedish Enterprise - **Svenskt Näringsliv**
	The Science Council - **Vetenskapsrådet**
	The Swedish Agency for Innovation Systems - **VINNOVA**
Type:	National Foresight process – covering various fields of S&T as well as socio-economic and cultural trends
Organizer:	Teknisk Framsyn
Duration: 2003-2004	**Budget:** €1.7 M **Time Horizon:** 2020-2025

Purpose

Teknisk Framsyn's second foresight study aimed to identify the preconditions for sustained technological progress and economic growth for Sweden over a 15-20 year period to 2025. With its intention of inspiring the coming generation of decision-makers who will shape Sweden's future, the project was directed at the private sector as well as government, public sector policies and organizations.

Sweden's Future from a Global Perspective

Teknisk Framsyn's second foresight exercise was launched as part of a national effort for Choosing Strategies for Sweden. This arose from the concern that not all organizations in Sweden possessed the capability or the capacity to engage in future-guided activities. The study followed a first foresight exercise, completed in 2000, which resulted in a report called The Foresighted Society.

The point of departure was the recognition that Sweden needed to consider its future from a global perspective. Within this context, the project aimed to:

Strengthen future-oriented and guided activities within organizations in both private and non-private sectors.
Identify competence areas with strong growth and innovation potential for Sweden economically, socially and ecologically.
Engender a basis and create processes for priority-setting for Sweden to further develop knowledge and competence areas in the national innovation system.

This foresight project was officially described as an 'update' of the previous technology foresight programme. The project was led by a management board, a director, and a steering group all representing the various organisations that stand behind it. The daily operations of the project were directed by a part-time project leader and five panel managers (supported by project assistants) representing the organisations in the management. Project managers were aided by a Methodology Group that acted as a scientific advisory board. In addition, an Information Group was formed and a web space created to provide a forum for both internal and external information and communication about the project.

The project was conducted through a combination of panel discussions, interviews and hearings and open forums. A number of panels were set up around the following themes:

Other National Foresight Programmes, Inspiration for Innovation, Upgrading (Swedish) Foresight. The latter consisted of seven focused projects and panels dealing with Technological Environments, tasked with updating the findings from the first foresight study. These were: Information Technology, Production Systems, Materials, Infrastructure for a Borderless Europe, Biological Sciences, Health, and Education. In forming these panels, there was emphasis on ensuring a diversity of backgrounds. Furthermore, a final Synthesis Panel, comprising 12 experts of varied backgrounds, brought together all the project's findings into a synthesis report, Choosing Strategies for Sweden. In addition, this Synthesis Panel broadened the perspective of the discussion to include economic and social preconditions – such as the innovation climate, tax system, institutions and regulations.

Harnessing Technology for Sweden's Future

The panels identified more than 500 fields of technology or knowledge considered to be potentially important for Sweden's future. Of these, 100 fields were selected and assessed from an overall supply and demand perspective, i.e. how developed was the technology and how much demand was there for it. The panels took into account issues such as the proximity of a particular technology to the market (e.g. fuel cells), and the breadth of demand, i.e. in how many sectors and processes could a technology or knowledge conceivably be used, now or in the future?

Driving Forces

Sweden faces a number of driving forces that will be crucial to its long-term development and prosperity. These driving forces can be summarized as follows:

- Living in a **borderless world**. Increasing globalization in production, trade, products, travel and lifestyles will continue to change the fundamental preconditions of Sweden's development. Furthermore increased contact between people posits new challenges, for example the breakout of so-called 'Severe Acute Respiratory Syndrome' (SARS) in 2003. Aside from human suffering, this epidemic had severe economic consequences for many countries during 2003. Counter-forces to globalization will also increase, and terrorism will create global vulnerability.
- The **knowledge Society** is becoming more prevalent. More and more, Sweden is leaving behind the old industrial society and entering a society based more on information, knowledge and expertise. At the national, regional and local level, as in each individual company it is becoming vital to develop the capacity to use knowledge in various ways. Challenges are becoming more and more cross-technological, thus requiring different sets of training for the workforce of the future.

- **Individualization** is on the rise, while new groups are being formed and values are changing. New values based on strong individualization, combined with clear group affiliations are replacing old ones. Individualization, new groups and changing values open up new opportunities for new products and services and provide a strong potential for economic growth.
- Technology is **reshaping** society, and society is reshaping technology. In particular, developments in information technology (IT) and biotechnology will greatly change how people live. The digital revolution, with its new communications and information technology, has changed society and its way of living. The effects of the new biology will probably be equally great over time. There will be a greater need for human resources capable of adopting and adapting new technology in the economy and society in general.
- **Complexity** is leading to new demands. Ever-larger and more complex systems are being built (e.g. safety systems in cars, air-traffic systems, etc.), which means greater vulnerability to operational disruptions, sabotage and global spread of infections. These systems are extra complex precisely because they are socio-technological rather than merely technological.
- Global **climate change** is deepening, and the long-term exhaustion of non-renewable energy sources will create new conditions and challenges. The prevention of climatic change will become more and more important as a steering factor and boundary condition. Climatic issues are especially linked with energy production, energy conservation and energy policy in general. Climate change poses a severe

threat to the infrastructure and lifestyle. At the same time, it serves as a driving force for technological development and a potential for development of products and systems to reduce and manage the impact of humans on climate.

Sweden's Technological Edge

Over 500 fields of technology and knowledge were assessed from a supply and demand perspective. The supply perspective (path breaking, maturity of a technology) describes what technology and knowledge can contribute. While the demand perspective (markets and needs) describes what society can be regarded as needing or what can be sold in a market. The project analyzed the preconditions for fields of technology and knowledge in Sweden according to criteria such as publication of scientific articles, Swedish patents, and current research priorities and resource investments. The top 100 fields in which Sweden had the best preconditions were then categorized within 11 areas as outlined in the Box below.

- Safer/more secure complex systems
- Mechanical systems and structures
- Interactive technology
- Functional materials
- Environmental and life cycle technology

- Mobile energy supply
- Fixed energy systems
- Safety, security and protection
- Sustainable food production
- Accessible IT
- Health care technology

The project discussed four innovation strategies that were intended in various ways to offset the shortcomings of today's innovation systems. This is reflected in Figure 1 where the four strategies are positioned with respect to their focus on different phases of the innovation process and with respect to the main actors who need to provide inputs to drive innovation in these strategies.

Whether a market exists for a particular technology or not is also an important dimension that influences the choice of strategy required to develop this technology further. Both strategies 1 ('Dare to Invest') and 2 ('Broad-based effort') aim at advancing new and path-breaking technologies. Whereas Strategy 1 focuses on specific applications in existing markets, Strategy 2 is geared towards broad applications in future markets. Similarly strategies 3 ('Just do it') and 4 ('The train is leaving the station') are required for existing technologies that are yet to be developed locally. Strategy 4 is compatible with an orientation towards a broad spectrum of applications in future markets; specific applications in existing markets are addressed by Strategy 3. The 100 fields of technology and knowledge that were selected by the panels were all placed in one of theses areas and correspond to an effective innovation strategy.
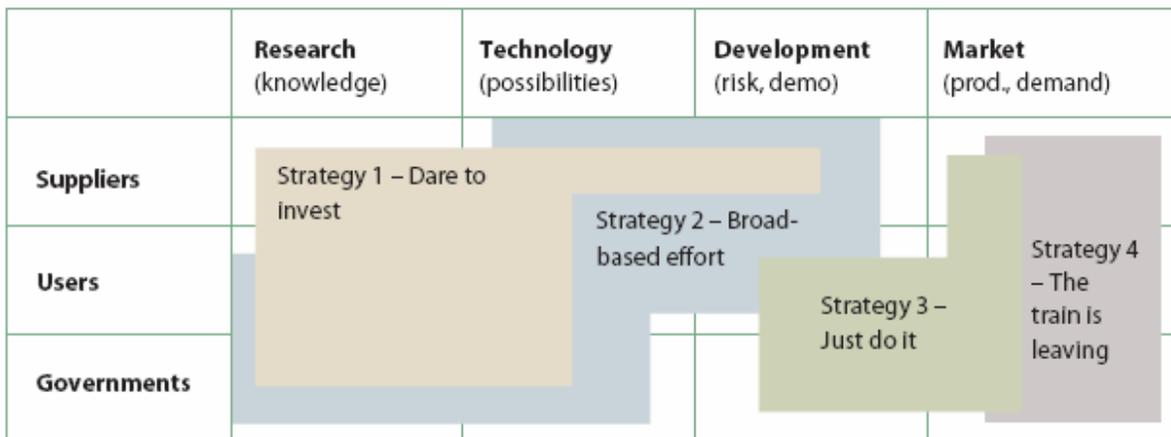
Daring to be Different

In setting out its vision for Sweden in the 21st century, the project presented the following six multifaceted and complex strategic choices:

- Swedes must see the opportunities of an enlarged world, not just the threats. To take advantage of the opportunities of globalization, Sweden must establish clear specializations. Sweden must build alliances with emerging markets, internationalize its educational system and actively pursue those issues that it believes to be the most important in the global arena.

- Sweden must dare to prioritize and focus. For a small, export-dependent nation like Sweden, it is impossible to be competitive in all fields. Sweden thus needs to concentrate its resources on strategic fields of activity. It needs to focus and specialize, both geographically and in terms of activities. For instance, Sweden should focus on businesses with high value-added, on expanding its production-related service sector (e.g. design, marketing, etc.), and on niches in specific fields of application where Sweden has the potential to build up and maintain in-depth expertise (e.g. complex systems, and high product customization).

- Sweden must concentrate its resources on investments and projects for the future. Swedish national infrastructure, which was largely built during the 1950s, 60s and 70s, is beginning to wear out and needs extensive maintenance. Swedes must ponder the implications of having roads, rail systems and cities that were built for the requirements and needs of the industrial society. What will be the communications, residential and living space needs in the future? Sweden should seriously regard the digital communications (broadband) network and the educational system as infrastructure that is as important as, or more important than, traditional concepts of infrastructure such as railroads. Extensive, high-quality infrastructure for digital communications is an important precondition for positive growth in nearly all areas of Swedish society.

- Sweden must modernize public sector commitments. Swedes must intensify the discussion and dare to make decisions on what services and what level of service should be offered in the future by the public sector, and what must be provided and paid for by individuals, especially in health and education.

- Sweden must become better at utilizing, evaluating and allowing room for the skills, creativity and commitment of every individual. Sweden must create optimism and a broad sense of participation of individuals in society. There must be clear leadership and opportunities for work, developing sound and healthy work organizations, taking advantage of diversity, ensuring the efficient exercise of government authority and creating a system of transfer payments and taxation that encourages studies and work. Sweden has to encourage innovative, knowledge-intensive operations, entrepreneurship, risk-taking and investments. Such activities must be allowed to be profitable for those who are prepared to engage in them.

- Sweden must take active steps to bring about a sustainable society. Swedes must develop new ways of converting and using energy so they can work, live and travel comfortably without destroying the environment. They need to redouble our efforts to develop sustainable products in more fields. Swedes must also intensify the task of creating intelligent rule systems and incentives in order to influence developments, both nationally and internationally.

Sources and References

- http://www.tekniskframsyn.nu

- Teknisk Framsyn (2004): Choosing Strategies for Sweden. A synthesis report from Swedish Technology Foresight, Stockholm
- Teknisk Framsyn (2004): Inspiration for Innovation – Swedish Technology Foresight 2004, Stockholm