

## OVERVIEW OF NANOTECHNOLOGY RESEARCH AND DEVELOPMENT IN FINLAND

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Finland has been regularly rated as one of the world's most competitive economies in recent years. Key factors contributing to this success, according to various studies, have been the country's excellent innovation environment and its strategic investments in science and technology. Governmental efficiency, a good social infrastructure and educational system, and efficient management have been identified as other strengths [1].

Recently Finnish success in ICT is increasingly being overshadowed by new challenges linked to globalisation and the slow response of traditional industries to change. Nanotechnology is often highlighted as a possible source of future national economic renewal and growth, especially as Nokia and many other large companies are now multinationals with steadily less ties to their home base [2]. The three largest industrial sectors in Finland - electronics, pulp and paper, and chemicals - all see nanotechnology as a key enabler for future innovation and renewal. The greatest potential offered by nanotechnology at the moment is seen as lying in new material solutions, developing new advanced features for existing products, and increasing the cost-efficiency of industrial processes.

**Tekes, Finnish Funding Agency for Technology and Innovation** ([www.tekes.fi](http://www.tekes.fi)) finances and activates R&D projects aiming to promote the competitiveness of Finnish industry. Nanotechnology has been chosen as one of key technology focus areas by Tekes. Tekes uses technology programmes to areas that are important for business and society, and allocates about half of the annual budget of 420 million euros through technology programmes [3].

**FinNano, the Finnish Nanoscience and Nanotechnology Programme** ([www.tekes.fi/finnano](http://www.tekes.fi/finnano)) is a multi-annual public funding programme for nanoscience and nanotechnology. It coordinates different action lines at national level. The FinNano technology programme activity focuses are: 1) innovative nanostructured materials, 2) new solutions for nanoelectronics and 3) nanosensors and nanoactuators. The duration of the programme is five years, spanning 2005 – 2010. The total budget is approx. 70 million euros. Tekes funding of the programme covers €45 million. Presently more than 85 companies and research units are participating in the FinNano nanotechnology programme. Tekes FinNano technology programme will be carried out in close cooperation with the Academy's FinNano research programme ([www.aka.fi/finnanoeng](http://www.aka.fi/finnanoeng)). The research programme has three thematic areas: 1) directed self-assembly, 2) functionality in nanoscience and 3) properties of single nanoscale objects.

In accordance with the strategic objectives of the FinNano programme, international co-operation is of major relevance to the programme. It is particularly needed for nanotechnology where scientific and technical challenges are huge and a wider critical mass is beneficial. The objectives of FinNano programme is to support national and international networking and researcher mobility and to promote participation by Finnish researchers, research institutions and enterprises in the European Union's nanotechnology research and development programmes. Excellent examples of ongoing networking include the European MNT and NanoSci ERA-Nets. Other ERA-NETs, such as ERA-Chemistry and MATERA (Materials), also have nanotechnology elements, and Finns are working actively in these, as

they are in the Nordic MINT initiative, looking at the problems of commercialising micro- and nanotechnology. The programme activates and supports collaboration between Finland and the two top nanotechnology countries USA and Japan, too. Emerging economies such as China will be among those most influential in determining how the coming era of nanoscience and nanotechnology unfolds - and Finland will need to address contacts with these countries.

Together with Tekes' programme, the Academy of Finland's nanoscience funding and the special action of the Ministry of Education (<http://www.minedu.fi>) the total Finnish investment in nanoscience and nanotechnology is secured up to €100 million before the end of this decade (2005-2010). The national actions will strengthen research and development prerequisites in the spearhead domains in Finland, which are nanomaterials, nanoelectronics and -photonics and nanobiotechnology [4]. Public investment together with additional private funding will create a strong and fruitful ground for new nanotechnology innovations and strengthens Finland's position as an innovative high-tech country.

**References:**

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- [3] Tekes, Finland, Annual Report 2005 (2005).
- [4] Committee on the development of nanoscience, Reports of the Ministry of Education, Finland **39** (2005), Nanoscience spearheads in Finland.