

NANOTECHNOLOGY AND INDUSTRIAL RENEWAL IN FINLAND

A synthesis of key findings

Christopher Palmberg & Tuomo Nikulainen

Elinkeinoelämän Tutkimuslaitos ETLA

Taloustieto Oy

ETLA B234
ISSN 0356-7443

ISBN 978-951-628-476-0

Painopaikka: Yliopistopaino, Helsinki 2008

ACKNOWLEDGEMENTS

This report summarises the findings from the 'Nanotechnology and the renewal of Finnish industries' (NANOREF) project. Funding by the Finnish Funding Agency for Technology and Innovation (Tekes), as part of the FinNano technology programme, and the Technology Industries of Finland Centennial Foundation, as part of the Finland in Global Competition project, is kindly acknowledged. We also wish to thank Petri Rouvinen, Pekka Ylä-Anttila, Mika Pajarinen, Terttu Luukkonen, the project steering group and numerous participants at conferences and seminars for their valuable comments.

Helsinki, 30.4.2008

Christopher Palmberg & Tuomo Nikulainen

CONTENTS

ACKNOWLEDGEMENTS

1	The NANOREF project	7
2	Nanotechnology as the next general purpose technology?	9
3	Project aims, limitations and report structure	12
4	Defining nanotechnology	13
5	Nanotechnology in Finland	15
6	Nanotechnology transfer as a key issue	22
7	Commercialisation routes: new versus established companies	28
8	Nanotechnology linkages throughout Finnish industries	35
9	Conclusions and policy observations	40
	References	46
	Appendix	48

1 THE NANOREF PROJECT

This is the final synthesis report of the NANOREF (Nanotechnology and Industrial Renewal in Finland) project undertaken by Etlatiето Ltd. The NANOREF project started in February 2006 and ended in October 2007. It was funded by the National Technology Agency of Finland (Tekes) and the Technology Industries of Finland Centennial Foundation.

After the exceptional success of information and communications technologies (ICT) and Nokia in the 1990s, concern has been raised about the sustainability of Finnish industrial renewal and competitiveness. The knowledge- and R&D-oriented strategy that Finland has pursued is coming under increasing competitive pressure due to developments in emerging newly-industrialised economies. Meanwhile, many traditional industries in Finland are seeking new innovation opportunities to renew themselves from within in a more fundamental way. The role of generic and enabling technologies has been especially important in the Finnish context in the past. This is best exemplified through the early application of digital technologies in the 1970s, which paved the way for the success in ICT. The application of ICT-related automation and process technologies has been pivotal for the competitiveness of the pulp & paper industry, and recently high hopes have been placed on the application of modern biotechnology and nanotechnology.

The NANOREF project found inspiration in some of these concerns, the previous success and present challenges that Finland has had in the fields of ICT respectively modern biotechnology. While ICT, modern biotechnology and nanotechnology are different types of technology fields all three of these share certain general purpose characteristics that can imply significant economic effects in terms of productivity and growth (indeed ICT has already proven some of its characteristics in this respect), and thereby represent fields in which countries are eager to build strongholds. The overarching aim of this project was to provide insights about the present role and future possibilities on nanotechnology to renew established, and create new industries in Finland. The project focused on issues related to the knowledge base of Finnish nanotechnology, technology transfer, establishment of new companies in the field and the links between nanotechnology and existing companies and industries in Finland. The project was primarily designed to support the ongoing Fin-Nano technology programme commissioned by the Finnish Funding Agency for Technology and Innovation (Tekes) during 2005–2010. The project was also

designed to further establish the competencies of Etlatieto in the economics of new/emerging technologies.

This report synthesises the key findings of the research and related publications undertaken during the project. The project has produced altogether six working papers (two of which also have been published in the working paper series of foreign institutions) and one forthcoming working paper related to another adjacent project. One of these working papers has been published in an academic peer reviewed journal while two others are being submitted. The project has also produced four other publications for the general public. In addition to the research publications, new databases were collected and several interviews were conducted with representatives from academia, industry and the public sector. Further, the results have been presented at seven conferences and/or workshops both in Finland and abroad.¹ The project will also generate one PhD thesis.

The project was headed by Christopher Palmberg (Etlatieto).² The researchers in the project, in addition to Christopher Palmberg, were Tuomo Nikulainen (Etlatieto) and Mika Pajarinen (Etlatieto) who provided invaluable assistance in data collection and analysis. The steering group of the project included Markku Lämsä (Tekes), Eija Ahola (Tekes), Runar Törnqvist (Helsinki University of Technology) and Pekka Ylä-Anttila (Etlatieto).

1 All NANOREF publications and presentations are listed under references at the end of this report and are referred to throughout.

2 Before the end of the project Christopher Palmberg took up a position at the OECD in Paris with responsibility over the Working Party on Nanotechnology (WPN).