

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)

Education, Technology and Industrial Performance in Europe explores the development of advanced scientific and technical education in seven European countries and the USA between the mid nineteenth century and the 1930s. The essays seek to replace the conventional notion of a simple interaction between education and industry with a far broader perspective in which not only educational institutions and industrial employers but also national and local governments, professional bodies, and private patrons can be seen to have made distinctive and often conflicting contributions. Although most of the essays are concerned with individual countries, the thrust of the volume is comparative. As the authors show, in nations as diverse as Belgium, Britain, France, Germany, Italy, Spain, and Sweden there were similarities in the conditions from which the spectacular innovations in higher technical education emerged in the later nineteenth century. But the results that were achieved were by no means uniform. A provision for education that was highly effective in one industrialized or industrializing economy could well be ineffectual in another. And everywhere the balance between the supply of educated manpower and the capacity of industry to exploit knowledge and skills was a delicate one. As educational innovators throughout Western Europe (as well as the USA) came to realize, there was no universally applicable ideal of education for industry.

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)

Education, technology and industrial performance in
Europe, 1850–1939

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)

This book is published as part of the joint publishing agreement established in 1977 between the Fondation de la Maison des Sciences de l'Homme and the Press Syndicate of the University of Cambridge. Titles published under this arrangement may appear in any European language or, in the case of volumes of collected essays, in several languages.

New books will appear either as individual titles or in one of the series which the Maison des Sciences de l'Homme and the Cambridge University Press have jointly agreed to publish. All books published jointly by the Maison des Sciences de l'Homme and the Cambridge University Press will be distributed by the Press throughout the world.

Cet ouvrage est publié dans le cadre de l'accord de co-édition passé en 1977 entre la Fondation de la Maison des Sciences de l'Homme et le Press Syndicate of the University of Cambridge. Toutes les langues européennes sont admises pour les titres couverts par cet accord, et les ouvrages collectifs peuvent paraître en plusieurs langues.

Les ouvrages paraissent soit isolément, soit dans l'une des séries que la Maison des Sciences de l'Homme et Cambridge University Press ont convenu de publier ensemble. La distribution dans le monde entier des titres ainsi publiés conjointement par les deux établissements est assurée par Cambridge University Press.

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)

Education, technology and industrial performance in Europe, 1850–1939

Edited by

Robert Fox and Anna Guagnini



EDITIONS DE

LA MAISON DES SCIENCES DE L'HOMME

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)

Published by the Press Syndicate of the University of Cambridge
 The Pitt Building, Trumpington Street, Cambridge CB2 1RP
 40 West 20th Street New York, NY 10011-4211, USA
 10 Stamford Road, Oakleigh, Victoria 3166, Australia
 and Editions de la Maison des Sciences de l'Homme
 54 Boulevard Raspail, 75270 Paris Cedex 06

© Maison des Sciences de l'Homme and Cambridge University Press 1993

First published 1993

A catalogue record for this book is available from the British Library

Library of Congress cataloguing in publication data

Education, technology and industrial performance in Europe, 1850-1939
 / edited by Robert Fox and Anna Guagnini.

p. cm.

Includes bibliographical references and index.

1. Technical education - Europe - History.
 2. Efficiency, Industrial - Europe - History.
 3. Technology - Europe - History.
- I. Fox, Robert, 1938- . II. Guagnini, Anna.

T105.E33 1993

607.1'14-dc20

92-23171 CIP

ISBN 0 521 38153 3 hardback

ISBN 2 7351 0481 8 hardback (France only)

Transferred to digital printing 2004

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)

Contents

| | |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| <i>Notes on contributors</i> | <i>page</i> ix |
| <i>Preface</i> | xiii |
| Introduction | 1 |
| I Setting the pace | 11 |
| 1 Worlds apart: academic instruction and professional qualifications in the training of mechanical engineers in England, 1850–1914 <i>Anna Guagnini</i> | 16 |
| 2 The training and career structures of engineers in France, 1880–1939 <i>André Grelon</i> | 42 |
| 3 Technical education and industrial performance in Germany: a triumph of heterogeneity <i>Wolfgang König</i> | 65 |
| II Coping with the giants | 89 |
| 4 The training of engineers in Belgium, 1830–1940 <i>Jean C. Baudet</i> | 93 |
| 5 Technical education, engineering, and industrial growth: Sweden in the nineteenth and early twentieth centuries <i>Göran Ahlström</i> | 115 |
| 6 Industrialization and technical education in Spain, 1850–1914 <i>Santiago Riera i Tuèbols</i> | 141 |
| 7 Academic qualifications and professional functions in the development of the Italian engineering schools, 1859–1914 <i>Anna Guagnini</i> | 171 |
| | vii |

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)

| | | |
|------------|---------------------------------------------------------------------------------------------------------------------------------|-----|
| viii | <i>Contents</i> | |
| III | The exploitation of knowledge | 197 |
| 8 | France in perspective: education, innovation, and performance in the French electrical industry, 1880–1914 <i>Robert Fox</i> | 201 |
| 9 | Training for specialists: the precision instruments industry in Britain and France, 1890–1925 <i>Mari Williams</i> | 227 |
| IV | A transatlantic perspective | 251 |
| 10 | Education, industry, and the American university <i>Arthur Donovan</i> | 255 |
| | <i>Bibliography</i> | 277 |
| | <i>Index</i> | 289 |

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)

Notes on contributors

GÖRAN AHLSTRÖM is associate professor and senior lecturer in the Department of Economic History at Lund University. His doctoral thesis of 1974 dealt with Swedish economic policy and price development in the late eighteenth century. Since then, he has published on Swedish economic thought and the Swedish national debt in the eighteenth and nineteenth centuries, and is currently working on the role of international industrial exhibitions in the diffusion of technology. This study is a sequel to his comparative study of technical education and industrial development, *Engineers and Industrial Growth* (1982).

JEAN BAUDET is a *docteur ès sciences* of the University of Paris. He is the author of *Les ingénieurs belges* (1986) and editor-in-chief of the Belgian periodical *Ingénieur et industrie*. After early work in phytochemistry, he has been engaged, since 1978, in an epistemological reflection on the relations between science and industry, with special reference to the place of the engineer as the intermediary between science and industry. He lectures on the history of the engineering profession in the Belgian National Programme for the History of Science and Technology at the University of Liège.

ARTHUR DONOVAN is a member of the Humanities Department at the US Merchant Marine Academy. Although primarily an historian of science, he has published several essays on engineering education and the profession of engineering in the United States. His books include *Philosophical Chemistry in the Scottish Enlightenment. The Doctrines and Discoveries of William Cullen and Joseph Black* (1975) and (as editor with Larry and Rachel Laudan) *Scrutinizing Science. Empirical Studies of Scientific Change* (1988). He has also edited *The Chemical Revolution. Essays in Reinterpretation*, published as volume 4 of the second series of *Osiris* (1988), and written a biography of Antoine Lavoisier (to be published by Blackwell, Oxford).

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)x *Notes on contributors*

ROBERT FOX became professor of the history of science at the University of Oxford in 1988. He had previously taught at the University of Lancaster and had been Assistant Director of the Science Museum, London, and (as a *directeur de recherche associé* in the CNRS) Director of the Centre de Recherche en Histoire des Sciences et des Techniques at the Cité des Sciences et de l'Industrie in Paris. His main publications have been concerned with early theories of heat and thermodynamics, the social and institutional history of science and technology in France, and the history of technical education and applied research in modern Europe.

ANDRE GRELON is *maître de conférences* in the Ecole des Hautes Etudes en Sciences Sociales in Paris and *chercheur associé* in the LAS-MAS/CNRS (Institut de Recherche sur les Sociétés Contemporaines). His publications have been chiefly concerned with the history and sociology of French engineers in the nineteenth and twentieth centuries, with special reference to their education and training. He is the editor of *Les ingénieurs de la crise. Titre et profession entre les deux guerres* (1986), and recently contributed two substantial chapters to the first volume of the *Histoire générale de l'électricité en France* (1991).

ANNA GUAGNINI studied the philosophy of science at the University of Milan. She worked at the University of Manchester Institute of Science and Technology and the University of Lancaster and was a *chercheur associé* in the CNRS, in the Centre de Recherche en Histoire des Sciences et des Techniques at the Cité des Sciences et de l'Industrie in Paris before holding a Senior Research Fellowship at Linacre College, Oxford, from 1989 to 1992. She is the author of *Scienza e filosofia nella Cina contemporanea. Il dibattito teorico negli anni 1960–1966* (1981) and of several articles on the history of technical education and research in Britain and Italy. She is currently working at the University of Bologna on a comparative study of the relations between applied research and industrial practice in modern Europe.

WOLFGANG KÖNIG studied history, geography, sociology, and political science, and was subsequently secretary for the history of technology and technology assessment in the Verein Deutscher Ingenieure before becoming professor of the history of technology at the Technical University of Berlin in 1985. His interests include the history of education, the engineering profession, and mechanical and electrical engineering, the historiography of technology, technology assessment, and the philosophy of technology. He is currently working on technology in consumer

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)

Notes on contributors

xi

society, the early history of electrical engineering as an academic discipline, and the history of machine design.

SANTIAGO RIERA I TUEBOLS holds doctorates in engineering and in contemporary history and is now professor of the history of science and technology at the University of Barcelona and the current president of the Societat Catalana d'Estudis Històrics. His published works include *Ciència i tècnica a la Il·lustració* (1985) and *L'Associació i el Col·legi d'Enginyers Industrials de Catalunya* (1988), as well as numerous articles on the history of engineers and the engineering profession in modern Spain. His present research is chiefly concerned with industrialization and the institutions for technical training in Spain during the nineteenth century.

MARI WILLIAMS took her doctorate at Imperial College of Science and Technology, London, after studying at the University of Cambridge. In addition to working in the corporate history unit of BP, she has held research positions at the Business History Unit of the London School of Economics and, as a *chercheur associé* in the CNRS, at the Centre de Recherche en Histoire des Sciences et des Techniques at the Cité des Sciences et de l'Industrie in Paris. She now works in the Policy Division of the Agricultural and Food Research Council, where she specializes in the evaluation of research and development. Her publications have been concerned with the history of technology, of astronomy, and of the oil industry.

Cambridge University Press

0521381533 - Education, Technology and Industrial Performance in Europe, 1850-1939

Edited by - Robert Fox and Anna Guagnini

Frontmatter

[More information](#)

Preface

This volume is the result of a long collaboration fashioned in the context of two international workshops, the first held at the University of Lancaster in July 1985, the second at the Cité des Sciences et de l'Industrie and the Maison des Sciences de l'Homme in Paris in July 1987. Comparative and interdisciplinary research of the kind which those workshops tried to promote is always difficult and, as editors, we are grateful not only for the patience and commitment of the authors of *Education, Technology and Industrial Performance in Europe* but also for the support we have received from a number of colleagues who have made important contributions as critics and through independent work of their own. These include Albert Broder, Ronald Ferrier, Thomas Hughes, Jonathan Liebenau, Peter Lundgreen, Joe Marsh, Gottfried Plumpe, Geoffrey Price, Robert Rosenberg, and Terry Shinn.

We also express our thanks for the funding that made the workshops and the many subsequent informal exchanges of views possible. In Lancaster in 1985, we were generously supported by the Economic and Social Research Council and the University of Lancaster; and the meeting in Paris was made possible by grants from the Fondation pour la Promotion des Entreprises à la Cité des Sciences et de l'Industrie and the Maison des Sciences de l'Homme and by the help we received in the Centre de Recherche en Histoire des Sciences et des Techniques of the Cité des Sciences et de l'Industrie, in particular from Anna Pusztai.

Robert Fox
Anna Guagnini