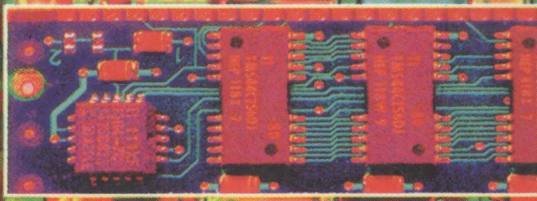
Technopoles of the World

The making of 21st Century Industrial Complexes



Manuel Castells
and
Peter Hall

ROUTLEDGE

TECHNOPOLES OF THE WORLD

The making of twenty-first-century industrial complexes

Manuel Castells and Peter Hall

London and New York

First published 1994
by Routledge
11 New Fetter Lane, London EC4P 4EE

Simultaneously published in the USA and Canada
by Routledge
29 West 35th Street, New York, NY 10001

Typeset in Garamond by
J&L Composition Ltd, Filey, North Yorkshire
Printed and bound in Great Britain by
Biddles Ltd, Guildford and King's Lynn

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Cataloging in Publication Data
applied for

ISBN 0–415–10014–3
0–415–10015–1 (pbk)

TECHNOPOLES OF THE WORLD

Cities and regions are being profoundly modified in their structure, and conditioned in their growth dynamics by the interplay of three major historical processes: technological revolution, the formation of a global economy, and the emergence of an informational form of economic production and management.

Technopoles, planned centres for the promotion of high-technology industry, are the reality of these fundamental transformations, redefining the conditions and processes of local and regional development. Generating the basic materials of the informational economy, technopoles constitute the mines and foundries of the informational age, yet have received less attention than their counterparts of the industrial economy.

Technopoles is the first comprehensive survey of planned development in all its manifestations: science parks, science cities, national technopolis and technobelt programs. Case studies, ranging from Silicon Valley to Siberia, from the M4 Corridor to Taiwan and Korea, relate how technopoles begin, how they take shape, what each is striving to achieve and how well it is succeeding.

Embracing a host of disparate concepts, and a few myths, *Technopoles* distills the lessons from the successes and the failures, offering guidelines for national, regional and local planners and developers worldwide.

Manuel Castells is Professor of City and Regional Planning at the University of California, Berkeley, and Professor of Sociology at the Universidad Autonoma, Madrid. Peter Hall is Professor of Planning at University College London, and Professor Emeritus of City and Regional Planning at the University of California, Berkeley.

ACKNOWLEDGEMENTS

Our first thanks go to the Sociedad Estatal Expo '92 in Seville, Spain, for providing the financial support for the research on which this book is based. This support – specifically to analyze foreign experience as a basis for the construction of a technology center on the Expo '92 site in Seville (the Cartuja '93 project, described in Chapter 8) – funded our field work in Spain, France, Germany, the United Kingdom, Russia, Japan, Taiwan, and the Republic of Korea, and provided us with research assistance in analyzing our data. We are particularly grateful to Mr Ignacio Quintana, director of the Cultural Division of Expo '92, and to Mr Antonio Palaez, first coordinator of the Cartuja '93 project, for their invaluable support; without it, the study presented here would never have been possible.

We also wish to acknowledge financial support from the Committee on Research at the University of California at Berkeley, which made possible the production of the illustrations in this book, and from the Instituto Universitario de Sociologia de Nuevas Tecnologias at the Universidad Autonoma de Madrid. In addition, the Korea Research Institute for Human Settlements (KRIHS) provided institutional support for our work in Korea; and the Institute of Economics and Industrial Organization of the Russian Academy of Sciences, Siberian Branch, in Novosibirsk, did the same for our Russian investigations. In Berkeley, we were most ably assisted in our research by two outstanding graduate assistants of the Department of City and Regional Planning: You-tien Hsing and Hiro Izushi.

During our field work we were welcomed and assisted by officials and technical collaborators in many countries, too numerous to name individually; we should like to record our sincere thanks to all of them for the time and trouble they took to answer our questions. Specifically, we were afforded cooperation by colleagues who performed an invaluable role in smoothing our logistical and intellectual path through the interviews: Professor Joo-Chul Kim, in the Republic of Korea; Ms Natalia Baranova, in Novosibirsk; Professors Takashi Machimura, Dai Nakagawa, Tsunekazu Toda, and Mamoru Taniguchi, and Messrs Manuel Sanchez and Pedro de Mingo, in Japan; Dr Semra Téber and Professor Guy Benveniste, in France; Dr

Carmen Hass-Klau, in Germany; the principals of Segal Quince Wicksteed, in Cambridge; and Dr Clara Garcia and Dr Isabel Ramos in Seville.

In Berkeley, Martha Conway and Jane Sterainger performed an impeccable job in developing the software that produced the maps.

Finally, we acknowledge with thanks the service performed by a number of academic colleagues in different countries who commented on the manuscript in draft: Professors Jean-Paul de Gaudemar in Strasbourg, John Goddard in Newcastle upon Tyne, and AnnaLee Saxenian in Berkeley. Stephen Hamnett deserves special mention for providing exceptionally speedy last-minute corrections to the Australian MFP story.

Manuel Castells
Peter Hall
Madrid and London, January 1993

CONTENTS

FIGURES

TABLES

1

TECHNOPOLES: MINES AND FOUNDRIES OF THE INFORMATIONAL ECONOMY

There is an image of the nineteenth-century industrial economy, familiar from a hundred history textbooks: the coal mine and its neighboring iron foundry, belching forth black smoke into the sky, and illuminating the night heavens with its lurid red glare. There is a corresponding image for the new economy that has taken its place in the last years of the twentieth century, but it is only just imprinting itself on our consciousness. It consists of a series of low, discreet buildings, usually displaying a certain air of quiet good taste, and set amidst impeccable landscaping in that standard real-estate cliché, a campus-like atmosphere.

Scenes like these are now legion on the periphery of virtually every dynamic urban area in the world. They appear so physically similar – outside Cambridge, England or Cambridge, Massachusetts; Mountain View, California or Munich, Germany – that the hapless traveler, dropped by parachute, would hardly guess the identity of the country, let alone the city. The developments they represent go under a bewildering variety of names, which invariably permute a few key elements like Techno, Science, 21st Century, Park, Plaza, Polis, and -topia. In France, where there are certainly as many of them as anywhere else, they go under a generic name, *technopole*. It is so evocative that in this book we have decided to appropriate it for the English language.[1]

Generally, technopoles are planned developments. Some are pure private sector real-estate investments, and these happen to be among the most numerous but least interesting. A significant number, however, have resulted from various kinds of cooperation or partnership between the public and private sectors. They are promoted by central or regional or local governments, often in association with universities, together with the private companies that occupy the resulting spaces. And these technopoles, the more interesting ones, are invariably more than just plots to rent. They also contain significant institutions of a quasi-public or nonprofit type, such as universities or research institutes, which are specifically implanted there in order to help in the generation of new information. For this is the function of the technopole: it is to generate the basic materials of the informational economy.

Quite a number of the people in the buildings of these new technopoles do not usually make anything, though somewhere else, often not many miles away, in rather similar buildings – sometimes of slightly less elegance – other people are making the things they invent here. The things may be computers or VCRs or CD players, word processing or spreadsheet software, artificial systems, high-technology ceramics, genetically engineered drugs, or a thousand other new products. What the things have in common is that they embody information that has essentially been created here. These high-technology products – hardware and software, bulky products and almost immaterial ones – are the products and symbols of a new economy, the informational economy. The information they embody has been created in technopoles, and invariably the embodiment of the information into the products also occurs in technopoles, which thus constitute the mines and foundries of the informational age.

The informational economy has been less noticed than the industrial economy it is replacing, and technopoles have had less attention from academic analysts than factories and mills. Though there are books about science parks in individual countries, and isolated articles about bigger experiments like the Japanese technopolis program, there is no account that tries to bring together, in one descriptive-analytic account, the most important ventures in constructing technopoles worldwide.

This book has been written to try to fill that gap. In order to write it, we have literally traveled the world – from Silicon Valley to Siberia, from the Côte d'Azur of France to the middle of Korea, from South Australia to Andalucia. We have intensively studied more than a dozen technopoles worldwide: some long-developed and mature, some hardly even begun; some wildly successful, some apparent failures. In this book we try to tell how each began, how it has taken shape, what it is trying to achieve, and how well it has succeeded. And then we try to sum up our experience.

To start, however, we need to understand the true significance of the technopole phenomenon. These developments have not suddenly sprouted by some kind of accident, or just because of a passing fashion. On the contrary: they are deliberate attempts, by farseeing public and private actors, to help control and guide some exceedingly fundamental transformations that have recently begun to affect society, economy, and territory, and are beginning to redefine the conditions and processes of local and regional development.

THREE CONTEMPORARY ECONOMIC REVOLUTIONS

Technopoles in fact explicitly commemorate the reality that cities and regions are being profoundly modified in their structure, and conditioned in their growth dynamics, by the interplay of three major, interrelated, historical processes:

1 A technological revolution, mainly based in information technologies (including genetic engineering), at least as momentous historically as the two industrial revolutions based on the discovery of new sources of energy.[2]
2 The formation of a global economy, that is, the structuring of all economic processes on a planetary scale, even if national boundaries and national governments remain essential elements and key actors in the strategies played out in international competition. By a global economy we understand one that works in real time as a unit in a worldwide space, be it for capital, management, labor, technology, information or markets.[3] Even firms that are anchored in and aimed at domestic markets depend on the dynamics and logic of the world economy through the intermediation of their customers, suppliers, and competitors. The acceleration of the process of European integration and the creation of the new European Economic Area emphasize these tendencies towards globalization and interdependence in the world economy.
3 The emergence of a new form of economic production and management, that – in common with a number of economists and sociologists – we term informational.[4] It is characterized by the fact that productivity and competitiveness are increasingly based on the generation of new knowledge and on the access to, and processing of, appropriate information. As the pioneer work of Robert Solow and the subsequent stream of econometric research by the "aggregate production function" school of thought have shown, the last half-century has been characterized by a new equation in the generation of productivity, and thus of economic growth.[5] Instead of the quantitative addition of capital, labor, and raw material, typical of the function of productivity growth in both agrarian and industrial economies, the new economy, emerging in advanced industrial countries since the 1950s, has increasingly depended for its productivity growth on what econometric equations label the "statistical residual," which most experts translate in terms of the inputs from science, technology, and the management of information in the production process. It is this recombination of factors, rather than the addition of factors, that appears to be critical for the generation of wealth in our economy.[6]

Furthermore, the informational economy seems to be characterized by new organizational forms. Horizontal networks substitute for vertical bureaucracies as the most productive form of organization and management. Flexible specialization replaces standardized mass production as the new industrial form best able to adapt to the variable geometry of changing world demand and versatile cultural values.[7] This is not equivalent, as it is sometimes argued, to saying that small and medium businesses are the most productive forms of the new economy. Major multinational corporations

continue to be the strategic nerve centers of the economy, and some of its most innovative actors. What is changing is the organizational form, both for large corporations and small businesses. Networks are the critical form for the flexible process of production. They include networks between large firms, between small and large firms, between small firms themselves, and within large firms that are decentralizing their internal structure, breaking it up in quasi-independent units, as so dramatically illustrated by the recent restructuring of IBM to offset its losses.

INFORMATION AND INNOVATION

These three processes are interlinked. The informational economy is a global economy because the productive capacity generated by the new productive forces needs constant expansion in a world market dominated by a new hierarchy of economic power, which is decisively dependent on information and technology, and is less and less conditioned – non-renewable energy sources temporarily excepted – by the cost of labor and raw materials.[8] The technological revolution provides the necessary infrastructure for the process of formation of the global, informational economy, and it is fostered by the functional demands generated by this economy. New information technologies are critical for the processes and forms of the new economy, on at least three levels.

First, they provide the material basis for the integration of economic processes worldwide, while keeping the necessary organizational flexibility for such processes. For instance, microelectronics-based manufacturing allows advanced standardization of parts of a given industrial product, produced in various locations, for assembly near the final market, while providing the necessary flexibility for producing in short runs or in large quantities, depending upon changing demand. The increasing integration of telecommunications and computing forms the technological infrastructure of the new global economy, as railways provided the material basis for the formation of national markets in nineteenth-century industrialization.

Second, industrial producers of new technologies have been the fastest-growing sectors in the world economy in the last 25 years, and in spite of business cycles they have certainly not yet reached their mature stage, driven as they are by constant innovation. Thus, such sectors play the role of growth engines for the development of countries and regions, with their greatest potential at the upper levels of the technological ladder, in industries characterized by a strict spatial division of labor between the innovation function, advanced fabrication, assembly, testing, and customized production. The more countries and regions are able to generate the development of these new, technologically-advanced industries, the greater their economic potential in the global competition.

Third, this information-driven technological transformation of the

global economy requires a rapid modernization process of all sectors of the economy so that they are able to compete in an open economy. Thus, whether we consider the fate of nations, regions, or cities, technological diffusion becomes even more critical than the development of high-technology production.

In theory, such technological modernization could proceed quite independently from the design and production of advanced technological devices. However, empirical evidence shows that the technological potential of countries and regions is directly related to their ability to produce, indeed manufacture, the most advanced technological products, which constitute technological inputs that condition the improvement of products and processes in downstream industries.[9] This is for three reasons:

1 Technological innovation, and the application of such innovations, depends on the process of learning by doing, rather than off-the-shelf operation manuals. Thus, the greater the capacity of a country and region to design and produce advanced technological inputs, the greater its ability to adapt these technologies to productive processes elsewhere, creating a synergistic interaction between design, production, and utilization.[10]
2 All technical division of labor becomes, over time, a social division of labor. This means that in a world governed by competition through comparative advantage, countries or regions specializing in the production of inputs that are required by other industrial structures have a definite advantage. The technological component of products thus becomes a decisive dividing line in the trade between countries.[11] Following Ricardo's classical rule, Portugal specialized in wine and England in manufactured textiles; but, before long, the best port wine was the favorite drink of English gentlemen enriched by the product of their textile mills. In a similar manner, if Amstrad becomes a packaging and marketing device for Korean computer parts and ICL becomes a front store for Fujitsu, it may not be long before City of London stockbrokers will find that the trading language of their shopfloor has changed from English to Japanese, or perhaps Korean. The point is that the balance of competitive advantage in both these cases, and indeed in all cases in the long run, is with the technologically-advanced partner. Nations ignore this rule at their peril: importing other people's technologies in order to develop value-added services may employ a few people, but the resulting employment growth is likely to be both modest and highly volatile, as a comparison of the recent course of the Japanese and German economies with the British and American ones will amply demonstrate.[12]

In sum, the technological basis of countries and regions becomes critical for growth because, ultimately, the deficit in the balance of trade between high-value, high-technology producers, and low-technology, low-value

producers creates an untenable disequilibrium. Research by Dosi and Soete on comparative trade patterns has demonstrated the fundamental role of high-technology manufacturing and the technological level of industrial sectors in international competitiveness.[13] Thus, if countries or regions do not generate sufficient surplus to import and adapt new technologies, they will be unable to afford the imports necessary for the modernization of their traditional industries.

3 Third, the culture of the technologically-advanced, information-based society cannot be productively consumed if there is no significant level of innovation in the social fabric. To be sure, the middle classes in developing countries can buy VCRs and personal computers. But only in a country, in a region, in a locality, where innovative informational processes are taking place can the generation of new ideas and new forms of organization and management occur in a creative manner. In other words, what is characteristic of the new informational economy is its flexibility, its productive adaptation to the conditions and demand of each society, of each culture, of each organization. To replicate the industrial organization of standardized mass production in the informational age, merely by buying the use of the technology without truly using its potential, is like using word-processing capacity to standardize the work of typing pools, instead of automating the process and upgrading secretarial work to the programming of more complex tasks.[14]

Technological innovation, the production of technologically-advanced devices, and technological diffusion cannot be entirely disjointed processes. Obviously not many regions in the world can excel in all three dimensions, and some inter-regional and international division of labor will always take place. However, no country or region can prosper without some level of linkage to sources of innovation and production. If this sounds an impossible task, it is because of an exceedingly simplistic notion about high-technology innovation and production. High technology is shorthand for a whole array of new products and processes that goes far beyond microelectronics, even if microelectronics was the original core of the technological revolution. Informatics (hard and soft), telecommunications, genetic engineering, advanced materials, renewable energy, specialty chemicals, information processing, bioelectronics, and so many other fields and subfields of technological innovation, advanced manufacturing, and technological services, offer so many opportunities that the scope of the new industrial geography, with its different levels of specialization and its diversity of markets, is broader by far than that generally accepted.

CITIES AND REGIONS: THE NEW ECONOMIC ACTORS

What we are witnessing, then, is the emergence of a new industrial space, defined both by the location of the new industrial sectors and by the use of

new technologies by all sectors. At the same time, such new industrial space is globally interdependent, both in inputs and markets, triggering a restructuring process of gigantic dimensions that is felt by cities and regions around the world.[15]

Indeed, the most fascinating paradox is the fact that in a world economy whose productive infrastructure is made up of information flows, cities and regions are increasingly becoming critical agents of economic development: as Goodman puts it, the last entrepreneurs.[16] Precisely because the economy is global, national governments suffer from failing powers to act upon the functional processes that shape their economies and societies. But regions and cities are more flexible in adapting to the changing conditions of markets, technology, and culture. True, they have less power than national governments, but they have a greater response capacity to generate targeted development projects, negotiate with multinational firms, foster the growth of small and medium endogenous firms, and create conditions that will attract the new sources of wealth, power, and prestige. In this process of generating new growth, they compete with each other; but, more often than not, such competition becomes a source of innovation, of efficiency, of a collective effort to create a better place to live and a more effective place to do business.

In their search for the new sources of economic growth and social well-being, cities and regions are stimulated both negatively and positively by comparative international experience. Those areas that remain rooted in declining activities – be they manufacturing, agriculture, or services of the old, non-competitive kind – become industrial ruins, inhabited by disconsolate, unemployed workers, and ridden by social discontents and environmental hazards. New countries and regions emerge as successful locales of the new wave of innovation and investment, sometimes emerging from deep agricultural torpor, sometimes in idyllic corners of the world that acquire sudden dynamism. Thus, Silicon Valley and Orange County in California; Arizona, Texas, Colorado, in the western United States; Bavaria in Germany; the French Midi, from Sophia-Antipolis via Montpellier to Toulouse; Silicon Glen in Scotland; the electronics agglomeration in Ireland; the new developments in southern Europe, from Bari to Malaga and Seville; and, above all, the newly industrializing countries of Asia (South Korea, Taiwan, Hong Kong, Singapore, Malaysia) that in two decades have leapt straight from traditional agricultural societies – albeit with high levels of literacy and education – to being highly competitive economies based on strong electronics sectors.

Such role models, both positive and negative, have a dramatic influence on the collective consciousness of countries, regions, and localities, as well as on the development projects of their respective governments. Many regions in the industrialized and industrializing world have dreamed of becoming the next Silicon Valleys, and some of them went headlong into