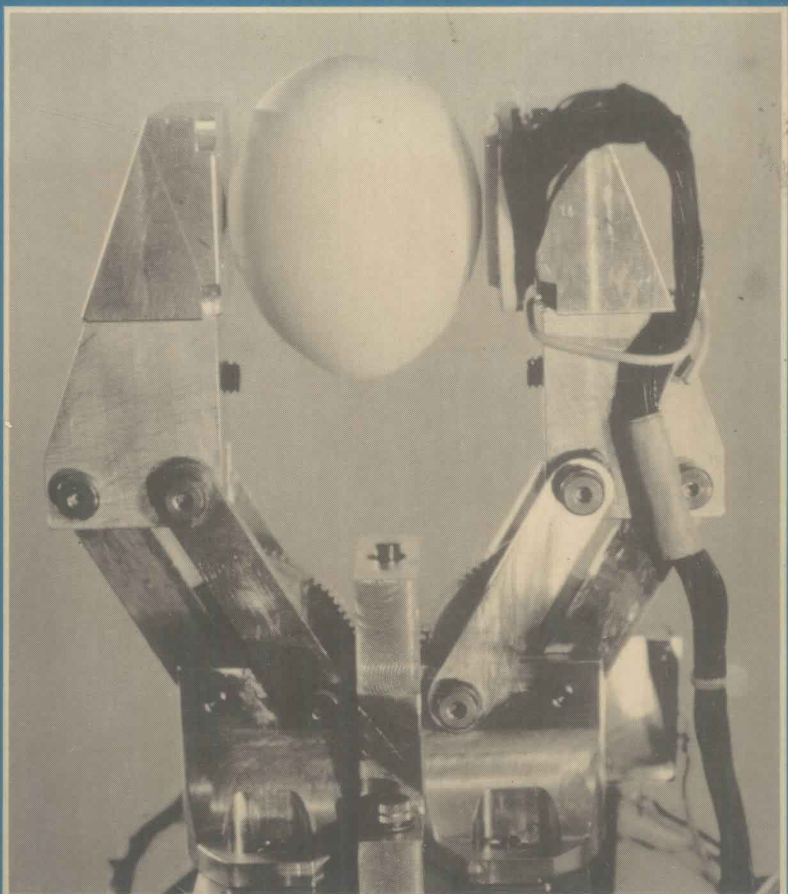
Work, Unemployment and the New Technology



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Foreword

In the latter half of the 1970s a new technology based on developments in microelectronics came to the notice of the general public for the first time. Sir Ieuan Maddock, former British government Chief Scientist, described it as 'the most remarkable technology ever to confront mankind'. The new technology is a 'heartland' technology; it can be applied to every sector of industry and commerce and few occupations will escape its impact. The 'silicon wonder' has not only stirred the public imagination, as witnessed by the growth in personal home computers, but is now seen as a major issue by industry, commerce, politicians, economists, academics and the news media. One major area of social concern is the effect that the new technology will have on work, skills, employment levels and work patterns. What is the future of work in the 'information age'?

This book sets out to take a critical look at how our working lives are likely to be affected by present and future technological innovation. It is a small book on a large and complex subject; I have inevitably had to be highly selective in my choice of subject matter and I can only hope that it represents a small contribution to what is, or ought to be, a matter of major public concern.

This book owes an enormous debt to a number of my colleagues. In particular, I would like to thank Anthony Giddens of King's College, who read my entire manuscript several times. He saved me from many mistakes, questioned many of my judgements, and tempered the dogmatism of my style. Elizabeth Garnsey, University Lecturer in Industrial Sociology in Cambridge University Engineering Department, and John Thompson of Jesus College also deserve special mention. I would also like to thank several of my engineering colleagues who brought to my attention a number of important literature sources and who patiently explained to me the complexities of the technology. None of them subscribes to the narrow

views of job design about which I have been so critical throughout the book. Finally, I must acknowledge my own debt to the new technology. The word processor which I used to type the manuscript considerably shortened the time required to produce a final version of the book.

Colin Gill, University of Cambridge, January 1985.

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FMS	Flexible manufacturing systems
FRG	Federal Republic of Germany
ILO	International Labour Office
LO	Federations of Trade Unions (in various Scandinavian countries)
LSI	Large-scale integration
MITI	Japanese Ministry for Industry and Technology
NAF	Norwegian Employers' Confederation
NC	Numerical control
NEDC	National Economic Development Council
NTA	New Technology Agreement
OCR	Optical character recognition
OECD	Organisation for Economic Co-operation and Development
OTA	Office of Technology Assessment (USA)
PTK	Privattjänstemannakartellen (Swedish Federation of Salaried Employees in Industries and Services)
PTT	Postal, telecommunications and telephone services
QC	Quality circles
QWL	Quality of working life
SAF	Svenska Arbetsgivareföreningen (Swedish Employers' Confederation)
SCB	Swedish National Central Bureau of Statistics
SPD	Social Democratic Party (West Germany)
SPRU	Science Policy Research Unit
STU	Styrelsen för Teknisk Utveckling (Swedish National Board for Technical Development)
TCO	Tjänstemännens Centralorganisation (Swedish Central Organisation of Salaried Employees)
TUC	Trades Union Congress
UAW	Union of Auto Workers (USA)
VDU	Visual display unit
VLSI	Very large-scale integration
WRU	Work research unit

Glossary of Abbreviations

AFL–CIO	American Federation of Labor – Congress of Industrial Organisations
ALC	Arbetslivscentrum (Swedish Centre of Working Life)
ADP	Automatic data processing
AUEW - TASS	Amalgamated Union of Engineering Workers (Technical, Administrative and Supervisory Section)
CAD	Computer automated design
CAE	Computer automated engineering
CAM	Computer automated manufacturing
CBI	Confederation of British Industry
CEDEFOP	European Centre for Vocational Training
CFDT	Confedération Democratique du Travail
CGT	Confedération Générale du Travail
CGT–FO	Confedération Générale du Travail – Force Ouvrière
CNC	Computer numerically controlled
DCF	Discounted cash flow
DNC	Direct numerically controlled
EDP	Electronic data processing
EEC	European Economic Community
EFT	Electronic funds transfer
EPOC	Equal Pay and Opportunities Campaign
ETUC	European Trade Union Confederation
ETUI	European Trade Union Institute
FF	Försäkringsanställdas Förbund (Swedish Union of Insurance Employees)
FIET	International Confederation of Commercial, Clerical, Professional and Technical Employees
FLM	Italian National Federation of Metalworkers

Contents

Introduction

The New Information Society

We constantly hear today about the 'new technology' and how important it is for our future. Most people had never heard of the phenomenon before the end of the 1970s, and their experience was limited to a small number of gadgets based on microelectronics, such as pocket calculators, digital watches and electronic games. They may have known of the existence of word processors as being sophisticated and very expensive forms of typewriter, but the average person had probably never seen such a device, let alone had access to one. Of course, many were aware that computers were increasingly being adopted by a variety of organizations because their bills, wage or salary slips, air tickets, cheques and bank statements contained an array of digital figures, but this hardly seemed to be of major significance to their way of life.

After all, the members of modern societies are used to new inventions, and there was no particular reason to suppose that this 'microelectronics' technology was any more significant than other technological inventions that had emerged before. Ever since the dawn of the Industrial Revolution there has been a deluge of technological developments which have resulted in new products and industries, larger markets, increased productivity, economic growth and a level of prosperity which earlier generations would never have believed possible. Those who had predicted that the replacement of human labour by machines would lead to widespread unemployment and human misery had been proved wrong. Why then should this technology be any different from what had gone before? Surely the development of the new technology should create even more wealth, new employment opportunities, and perhaps even the dawn of a new 'information' age of increased leisure where human beings would be liberated from the constant need to work in order to survive?

Microelectronics has already been extensively applied in many sectors of industry and commerce, although not in a manner visible to the public. Robots are already installed in a number of manufacturing plants, and many people have seen television programmes depicting these strange machines working continuously on production lines. These 'steel-collar workers' do not need to be motivated to work and never need to take tea-breaks, nor do they submit wage demands. As the costs of applying microelectronic circuitry continue to decline, robots and other forms of computer-controlled machinery will be introduced on a massive scale into manufacturing industry. Not only will microelectronics be increasingly employed in the development of more sophisticated factory machinery, but it will also be incorporated into the design of the products themselves.

Microelectronics will be used in a wide range of applications apart from manufacturing industry. The growth of clerical employment, which was a feature of the early part of the present century, has already gone into reverse, and offices are being increasingly automated. The banking system by its very nature lends itself to the application of information technology – with its requirement for vast amounts of information storage, processing and transfer – much of it in numerical form. As microelectronics is increasingly incorporated into products, manufacture, design and services, it will bring about radical transformations in society and in work organizations.

It is clear that modern societies are being quietly and pervasively altered by powerful technological changes. There will be no turning back. The seeds of fundamental change in society have already been sown. Our way of life is going to be radically altered, for better or for worse, just as it has been in the past by such technological advances as the steam engine, electricity, the internal combustion engine and air travel. No doubt other technological developments such as genetic engineering and lasers will also significantly alter our way of life in the future. The key question is whether the difference between previous technological developments and information technology itself is such that we can justifiably describe what is happening as a second 'industrial revolution'.

The Emergence of the Microprocessor

Thirty years ago, electronic devices depended on the use of a vast array of vacuum tubes and valves, which required a lot of space, were expensive to produce and inefficient in terms of the power needed for their operation.

The transistor subsequently replaced these bulky materials and thus enabled a whole new generation of products to appear on the market. This meant that electronic equipment such as computers, television and radio sets became much more compact. However, these devices still had to be wired together, and since each single piece of equipment might have thousands of components which had to be connected with one another, electronic manufacture still remained a complicated and costly operation, and even then the various products were relatively bulky. Subsequently, the development of the integrated circuit allowed the transistors to be 'wired' together in one minute 'chip' comprising a vast, complicated circuit containing not only transistors, but also other components – such as resistors and diodes. Today, circuits containing 100,000 components in a chip measuring 5 millimetres across are commonplace. Yet the process of miniaturization is still only in its early stages, and it has been calculated that by the end of the present decade chips containing as many as a million elements will be available.

Parallel with these technological developments, mass production methods have reduced the cost of the chips to a tiny proportion of their cost three decades ago. A simple illustration of how dramatic these reductions in cost have been is that during the past 15 years the power of computers has increased by almost 10,000 times, while the price of each unit of performance has decreased 100,000 times. The computer of 1963 required several tens of thousands of hand-made connectors, all capable of failure. Today, the equivalent device would only require ten elements in a large-scale integrated circuit. It has been predicted that the largest computers constructed so far, which include hundreds of thousands of logic gates and memory capacities of over 32 million 'bits',[1] will, by the end of the century, be able to be contained in a shoe box and will cost around £700. An analyst at Massachusetts Institute of Technology (MIT) estimated that if today's computers are compared to cars in terms of cost and technology, the production of a Rolls-Royce would cost US $2.50 and it would run for 600,000 miles on a gallon of petrol.

Information Technology and Microelectronics

Alongside the developments in microelectronics, other related innovations have taken place which do not necessarily involve the application of microelectronics in an end-product. These include a range of technologies which, taken together, can be called 'information technology'.

When we speak of *information technology* we are referring to technologies relevant to human communication processes and to the handling of the information conveyed in these processes. In the broadest sense of the term, information simply relates to any and all facts that are communicated, learned or stored. Information science is now understood to mean the science by which computers process and store information; information technology is concerned with how computer-based information is stored, processed and transmitted – be it by telephone lines, cable, satellite, teletext or other means.

A key characteristic of modern information technology is that advances in microelectronics have gone hand in hand with innovations in telecommunications. Thus the fusion of information *processing* (represented by the role of computer technology) and communication (increasingly dominated by telecommunications) has brought about a revolutionary change in the quality of information *flow*. This means that more communicable information is available than ever before, and it can be processed much more efficiently and flexibly. It can also be transmitted and acted upon more rapidly.

Given the importance of information flow to the social infrastructure, the fusion of computers and telecommunications can be expected to bring about radical changes in the organization and administration of everyday social life. For example, information technology is applied in such areas as printing, telephone networks, broadcasting, and satellite communications; it involves the use of lasers, optical fibres, voice and speech synthesizers, infra-red light, sensory devices and so on.

Just as the Industrial Revolution affected the very fabric of society itself by shaping every form of human communications, so too does information technology. It does so by providing a storage medium for information and knowledge, much as the written word affected communication and human knowledge in earlier times. Not only does information technology provide a storage medium which is much more effective than the written language, but it can also extend communication from bridging time to bridging space. Its effects on society will therefore be just as significant as was the spread of printing on European thought in the Middle Ages.

We are moving increasingly towards an information society based on a microelectronic technology which is both capital- and labour-saving in its applications. The new technology is thus a 'heartland' technology