

---

# **The 'Chips' are Down**

The Future Impact of Microprocessors  
and Computers on Employment in Britain

---

A Discussion Paper by Colin Hines

Earth Resources Research Limited  
April 1978



## THE 'CHIPS' ARE DOWN

Colin Hines

This discussion paper emerged from current research for a report by the author, entitled GAINING GROUND, to be published later this year. This report will explore the potential for employment creation arising from the problem of derelict resources in Britain. Whereas the author makes no claim to be an expert in computer science or economics, after consulting experts in both these fields, he decided to publish this paper in an attempt to stimulate discussion of an extremely important topic which, hitherto, has been the subject of very limited debate.

The author gratefully thanks the following people for their valuable assistance: David Baldock, for his considerable help with the paper; Howard Rush, Mick McLean, Steve Hahn and Carl Payne, for their professional advice; Lynne Kaye-Plight and Sarah Swinburne for providing typing and cover layout.

- (21) See B.B.C.2's HORIZON programme, televised 30th March 1978.
- (22) See Poole J., *op. cit.*
- (23) See Goldwyn E., *op. cit.*
- (24) See *Impact Analysis by Industrial Sector - Case Studies*, McLean M. and Rush H., unpublished mimeo SCIENCE POLICY RESEARCH UNIT, March 1977.
- (25) *Ibid.*
- (26) *Ibid.*
- (27) See Goldwyn E., *op. cit.*
- (28) *Ibid.*
- (29) See McLean M. and Rush H., *op. cit.*
- (30) See Cooley M.J.E., *op. cit.*
- (31) *Ibid.*
- (32) *Ibid.*
- (33) *Ibid.*
- (34) See *LETTERS*, COMPUTER WEEKLY, 23rd February 1978.
- (35) See MANPOWER SERVICES COMMISSION (1977), *op. cit.*
- (36) See *Working towards a better job*, THE GUARDIAN, Clementson I., and Rodgers G., 9th August 1976.
- (37) See *The Potential for Substituting Manpower for Energy*, BATELLE MEMORIAL INSTITUTE, Social Affairs Division of Commission of the European Communities, 1977.
- (38) See *Micro Is Beautiful*, UNDERCURRENTS, Garrett J. and Wright G., No. 27, April-May 1978.
- (39) See *A shortage in the software department*, THE GUARDIAN, Large P., 12 April 1978.
- (40) See MANPOWER SERVICES COMMISSION (1977), *op. cit.*: see UNIVERSITY OF CAMBRIDGE DEPARTMENT OF APPLIED ECONOMICS (1978): see *UNEMPLOYMENT 2001 A.D.*, Leicester C., INSTITUTE OF MANPOWER STUDIES, October 1977.



---

Other ERR publications currently in print:

**Wastage in the UK food system:** an analysis of the flow of food in the United Kingdom and of the losses incurred within the system. Author: Robin Roy. Price: 75p.

**The Paper Chain:** a report on the production, use, reclamation and recycling of paper in the United Kingdom. Author: Christine Thomas. Price: £2.

**The Fissile Society:** energy, electricity and the nuclear option. Author: Walter C. Patterson. Price: £1.50.

**The Politics of Urban Transport Planning:** an analysis of transportation policy formulation in three UK County Boroughs between 1947 and 1974. Author: John Grant. Price: £2.50.

**Changing food habits in the UK:** an assessment of the social, technological, economic and political factors which influence dietary patterns. Author: Chris Wardle. Price: £1.40.

---



**Earth Resources Research Limited**

Associated with Friends of the Earth Limited

## THE 'CHIPS' ARE DOWN

Growing attention is being paid to the possibility of mass unemployment and one recent report receiving widespread coverage, suggested that unemployment may approach five million by the 1990's.<sup>(1)</sup> Less publicity however is given to the technological advances in computers and other fields of microelectronics, the increased use of which could well result in unemployment figures of this kind becoming a reality. These developments could well prevent the Government from ever solving the unemployment problem, could put back the clock for women's liberation, and could make the work of middle management and many professionals resemble that of a car assembly worker. Yet the key to these new technical changes is a minute computer called a microprocessor. In the form of a silicon 'chip', a microprocessor can be as little as one centimetre square, can consist of 20,000 components and often cost less than £5.

The Government's present industrial strategy relies heavily on using public money to encourage increased investment and modernisation in British industry. An industrial sector with renewed efficiency and competitiveness is then supposed to take full advantage of the expanding world markets expected to materialise once the long-awaited upturn in world trade makes its appearance. Britain will then grow its way out of the recession. This improbable scenario invariably ends in hazy pronouncements to the effect that this will solve our unemployment problems.

In essence, the equation appears to be: a more competitive British industrial sector plus world economic upturn, equals economic growth plus lower unemployment. This glib formula may in fact be a cruel deceit since the purpose of additional investment is usually to raise productivity which will reduce rather than increase the number of jobs unless suitably compensated by stronger demand and a huge increase in output. To prevent further unemployment, a staggering increase in industrial output will be required. A forecast by the National Institute for Social and Economic Research estimated that for full employment to be restored Britain's GNP would have to grow at 5% per year for five years.<sup>(2)</sup> This implies an annual growth rate in manufacturing and exports of an incredible 8½% and 16% respectively.<sup>(3)</sup> As Kenneth Baker MP pointed out in "The Guardian" last year: *"to believe in the impossible and to hope for the unobtainable is no basis for a constructive policy"*.<sup>(4)</sup>

One of the reasons why it will be difficult to tackle unemployment in the near future is the legacy of the high birth rates of the late 50's and early 60's, which means for the next few years there will be an increase in the U.K. labour market of 170,000 per annum.<sup>(5)</sup> This figure is comparable with an increase of a mere 168,000 over the last five years.<sup>(6)</sup> The effect, according to the Manpower Services Commission will be a 'job gap' of 2,320,000 by 1981.<sup>(7)</sup>

If Britain is to recover from the present recession the Government must be hoping for sustained growth at least on the scale enjoyed in the 50's and 60's. Yet the probability of a world recovery of this order now **seems to be remote**, since most of the growth areas which fuelled that boom are no longer expected to expand as rapidly again.<sup>(8)</sup> During that era, over 80% of all the fastest expanding products could be categorised into six areas: electronics, synthetics, drugs, agricultural chemicals, consumer durables and energy.<sup>(9)</sup> In the West the market for cars, TV's etc. has virtually stopped growing and the industries concerned will have to content themselves largely with the replacement market. (In the Third World, the growing demand is



increasingly being satisfied by countries such as Japan and Korea.) Most large chemical firms producing synthetics, drugs and agricultural chemicals have accepted that growth rates will inevitably be slower in the 70's and 80's than they were in the 50's and 60's, owing to factors such as rising energy costs, saturated markets and increasingly stringent legislation concerning product safety.(10)

All this, along with such factors as falling rates of profit and the rise in company indebtedness has meant that over the last decade industries in the USA, Germany and most other advanced economies have been gradually adapting their patterns of investment. OECD studies show that there has been a shift in emphasis away from the construction of new plant towards "rationalisation" and "replacement" investment within existing plant and factories.(11)

However serious the effect of low growth expectations and rising productivity for employment, the situation is made very much worse by the rapidly increasing use of electronic hardware such as computers and their tiny offspring the microprocessor. It is the use of this equipment which will enable rationalisation to occur with a vengeance.

Computers were initially employed to store, manipulate, retrieve and organise vast quantities of statistical information (known as data processing), but now they are increasingly used in control, monitoring, regulation and automation. Their changing role has been made possible by technological advances which have effected an increase in the speed, reliability and power of computers as well as a dramatic reduction in their cost and size. Yet it is the invention of microprocessors which will have the most profound effect on unemployment in the final quarter of this century. This development enables a limited task to be carried out very quickly, accurately and cheaply and is rapidly being introduced into a wide range of industries and services.

This is not a new threat of course. Fears that computers were taking over were common in the fifties and many people considered that progress towards a leisured society would be rapid. Not surprisingly, both views were discredited or forgotten when such changes failed to occur.

Such predictions were not totally wrong, however. It was simply that the visionaries concerned had failed to allow for the time needed for such developments to gain social and economic acceptance, and for the necessary accompanying technological improvements like microprocessors to be developed.

The speed, reliability and power of computers and cheap microprocessors have vastly increased the potential for automation. They are already in use in the control of power stations, textile mills, telephone switching systems, office heating and type-setting, as well as in repetitive mechanical tasks such as welding and fault finding in the car industry. They are even found in most types of digital watches and pocket calculators. However as the cheap microprocessor penetrates more and more sectors of the economy, it will have increasingly wide-ranging effects as it will enable automation to be introduced on a far larger scale than previously possible. Recently, Barrie Sherman of ASTMS, warned in "Computer Weekly" that: *"we were now on the threshold, if not already involved in, a quantum leap in technical change".*(12)



The reason that microprocessors are so devastating is that they have introduced flexibility into automation. In the 50's and 60's, it was only possible to automate at great expense for one specific task, and hence the product concerned had to have a steady, virtually guaranteed market, engine crank shafts for example. Now however with the introduction of microprocessors, automated robots can be used for one particular task, and, should demand change, they can be reprogrammed for another; in some cases in less than half an hour. Mick McLean of Sussex University's Science Policy Research Unit sees this as the major new development in automation. The process is still expensive, but he is convinced that automation has finally come home to roost because the technology has developed to the point where it is often as flexible as the retraining of people. (13)

Amongst the first casualties of automation are firms making mechanical precision watches, cash registers and telephone equipment. Digital watches, made in the United States have already had a shattering effect on the Swiss watch industry, forcing seventeen firms to go out of business, causing widespread unemployment and resulting in the transfer of this 200 million dollar industry to the States. (14)

Employment effects of this kind have also been felt by the labour force in the States itself. Cheap reliable microprocessors have made it possible to discard almost all the mechanical moving parts from the cash registers and replace them with a microprocessor in the form of a minute silicon chip. The 1975 Annual Report of National Cash Register, the world's leading manufacturer, stated: *"We can now produce . . . micro-circuits, not much bigger than the head of a pin which contain up to 16,000 components. These replace mechanisms that require hundreds of individually mechanised parts and scores of space-consuming machine tools and manufacturing processes to produce them."* This has contributed to the fact that between 1970 and 1975, National Cash Register reduced its workforce in the manufacturing sector by more than 50%, from 37,000 to 18,000. (15)

In the telephone equipment industry, Western Electric, the manufacturing arm of American Telephone and Telegraph who supply the majority of the telephone systems in North America, has seen its labour force drop from 39,200 in 1970 to 19,000 in 1976. The rapid introduction of electronics has not only affected the manufacturing sector; Western Electric have estimated that it will also result in a 75% cut back in the need for labour in fault-finding, maintenance, repair and installation work. All major telephone equipment companies in Europe are faced with the same problems of transition. In the UK, the number of jobs is expected to fall by 30% between 1976 and 1979, despite a slower shift to electronic technology. (16)

Whenever the employment effects of such industrial developments are questioned, the usual response is an expectation that the slack will be taken up by the service sector, which has been the major employment growth area since the war. Unfortunately the long electronic arm of the microprocessor is likely to have just as devastating an effect on those employed in services, as it has begun to have on those in the industrial sector. Over half the workforce is now employed in services of some kind, compared with 30% in 1964. Cutbacks in Government expenditure have already reduced employment in the public sector, but all service industries will be affected by technical developments of a type normally chronicled only in such obscure technical journals as "Computer-Aided Design" (17), "Microprocessors" (18) and "Computer Communications". (19)

Take the retail trade, for example. The electronic cash register and the increasing use of computers for stock control are probably the most significant introduction in employment terms since self-service stores some thirty years ago. Larger stores are installing computerised 'point of sale' systems consisting of an electronic cash register which not only adds up prices, and checks the customers' credit-worthiness, but sends its information in parallel with that of other check points and branches to a computer situated in the company's warehouse. The replenishing stocks can then be assembled to be taken to whatever branch needs them.(20) These terminals can also keep records of how fast and accurately each employee works and in Denmark staff refused to use the equipment until such practices were stopped.(21)

Among the latest developments are laser beams, which 'read' bar codes printed on products and 'ring up' the price automatically, thus speeding up the check-out process and reducing the need for labour.(22) Bar codes could also save the labour involved in pricing each product individually since the price is shown at the point of display. Automated fork lift trucks and other materials-handling equipment will similarly speed up distribution until the day arrives when all that is left for the warehouseman to do is to ensure that the right load goes on the right lorry.(23)

These developments will clearly have some impact on the retail organisations introducing them, but their greatest effect will be felt by smaller retailers, unable to afford such equipment. Since they will not benefit from the lower wage bills that such innovations can bring, many of them might well be forced out of business.(24)

Lasers and computers are also likely to affect another labour-intensive service industry, which until now has experienced little automation - the garment trade. Micro-processor controlled laser cutters have already been developed and these will increase the speed and accuracy of garment pattern cutting and so the labour requirements will fall.

Without doubt, however, the most serious employment implications for the service sector will be the introduction of the 'word processing revolution' on office work in general, and secretarial work in particular.

The introduction of computers, accounting machines, pocket calculators, etc. has mechanised many of the information handling tasks previously performed by clerical workers, but with the exception of small increases in productivity brought about by electric typewriters, dictating machines and copying machines, 'secretarial work' has escaped any fundamental transformation.(25)

Word processing systems, which are normally electric typewriters with the addition of a memory, are however rapidly changing this. A 'memory typewriter' allows a typist to correct and edit previously typed work, without retyping the unaffected passages of text. More sophisticated word processing models enable a large variety of standardised letters and other documents to be automatically typed, leaving only the variable details to be filled in by the typist.(26)

In more advanced word processing systems, the typewriter is replaced by one or more visual display units, which are connected to a central computer with a very large-scale memory and centralised editing facilities. Documents are displayed and corrected using the screen and both intermediate drafts and final copies can be produced as required on a high-speed printer. Once a sufficient number of word processing devices has been installed



letters need never be typed at the sender's office, instead they can be routed by the word processor over a telephone line to the recipient's word processor where they can be printed. The copies can be stored magnetically by both the sender and the receiver. This of course has implications both for postmen and for other post office workers.(27)

As these systems become more widely used, growing numbers of secretaries and typists will be made redundant, since two or three word processors can do the same work as ten typists.(28) Investing in a word processor is fast becoming cost effective since for an outlay of £5,000 or less, a single typist can be replaced. The imminence of this change was summed up baldly by a Times article entitled: "The Four Thousand Pound Typist-Substitute That Will Soon Pay For Itself".(29) For the roughly 800,000 people, mostly women, employed as secretaries, this somewhat chilling title is likely to foreshadow major social changes. This is because the growth of typing and secretarial work has contributed to the increase in employment for women and has been responsible to some degree for their growing independence.

Nor is it only the more repetitive tasks that will be affected; computers and microprocessors are gradually being introduced into the field of intellectual work. Take designing for example. It has been predicted that the 1970's will see a decline in the total number of draughtsmen and women and related occupations, since even a simple computer system can 'draw' 25 times as fast as a skilled person.(30) Such applications will mean that these and other white collar workers will begin to experience the same problems and disadvantages that have long been the lot of manual workers whose working lives have been redesigned and adapted to fit the dictates of the increasingly expensive machinery that they use. For example, the need to make the optimum use of expensive, highly synchronised, computerised equipment will normally require shift work or systematic overtime. Furthermore, work will be fragmented into less satisfying, more narrowly-defined tasks often paced by the dictates of a computer. Rapid innovation in computer technology renders old equipment redundant along with the knowledge needed to operate it, and this can lead to experienced staff being replaced by younger ones versed in the latest advances.(31)

These changes have already resulted in stress and unrest with such varying consequences as: strikes by design staff protesting at the introduction of shift work and job-fragmentation;(32) a suggestion by a working party of the International Federation of Information Processing that mental hazards *'caused by inhumanely designed computer systems should be considered a punishable offence just as endangering the bodily safety'*;(33) and a recent letter in "Computer Weekly" from an experienced data processor in his early forties lamenting that a *'recruitment consultant informed me that they had great difficulty in placing applicants of over 40'*.(34)

All this is not to say that a Luddite-smash-the-computer-response to these developments would be appropriate; the need to remain internationally competitive leaves us with little alternative but to increase their application, since most other leading industrial nations already make more use of computers and microprocessors than we do in Britain. In any case, some applications of microelectronics have resulted in welcome advances in such fields as medicine and communications and the most frequently stated advantage of automated processes is their elimination of many tedious and repetitive tasks. This in itself would be commendable if it were not for the fact that as things stand, the people displaced are given little opportunity of any alternative work.

What is so disturbing is that so little thought is being put into tackling such structural unemployment. There are already 1,500,000 unemployed and past population growth will mean that at least an extra 1,500,000 will be seeking jobs between now and 1985.(35) All that the Government seems capable of providing are short-term palliatives. Solutions such as shorter working weeks, longer holidays, earlier retirement, raising the school-leaving age, work sharing, overtime bans etc, have all been half-heartedly suggested. In practice the difficulties would be enormous. At present, for example, the possibility of a successful pay policy being agreed without the safety valve of overtime, is almost inconceivable. Nevertheless these solutions will have to form a major part of any effective strategy for reducing unemployment, and as such require a far more determined approach than any so far attempted.

There is of course no shortage of work to be done. A huge number of jobs could be created by a more serious attempt to provide for unmet social needs. These could range from increasing the number of "ground level" health, education and social workers(36) to more ambitious schemes for rehabilitating the declining inner cities. A recent EEC study on 'The Potential for Substituting Manpower for Energy'(37) emphasised that the reconditioning of manufactured products that were built to last, would save energy and raw materials and would also create more jobs in the form of new and satisfying repair work in small workshops distributed throughout the country. The report showed that this change would provide more than enough jobs to compensate for those lost in the manufacturing industries and would also provide a more varied type of work less susceptible to automation.

On the rare occasions that the possibility of a growing number of permanent and increasingly embittered unemployed is discussed, the scenario usually invoked is one of violent social upheaval. Less speculative however are the crippling financial costs involved in supporting such people. Payments would have to be high, not merely for humanitarian reasons, but because without adequate benefits for the huge number unemployed, overall consumer demand would be insufficient to sustain our industrial system.(38)

What has to be faced over the next few years is that vast sections of the industrial and service sector will be automated and millions may lose their jobs. The extent of Government reaction to this specific problem seems at present to be limited to the formation of one advisory working party. This is expected to report to the Advisory Council for Applied Research and Development in June. Yet the Council itself is not expected to inform Government of its findings before the end of the year.(39) The present failure of the Government to confront these fundamental structural problems adequately cannot be disguised indefinitely behind a smokescreen of short-term job-creation measures and North Sea Oil optimism. Neither will ill-considered prattle rejoicing over the decline of the work ethic and boring jobs be of the least help to those for whom the present reality of such changes is permanent assignment to the dole queue.

There will be no easy, wand-waving solutions. Even the long-term palliatives suggested above are likely to flounder in the face of the seemingly insurmountable problem of who pays for earlier retirements, work sharing, more sabbaticals etc. It is likely that the miseries and upheavals of the 1930's will pale into comparative insignificance should Britain continue to drift on as at present, and find itself in the situation where two, four, six or even seven million are out of work.(40)

Priority must first be given to admitting the enormity of the problem and secondly to assemble the best brains in Government, research establishments, industry, unions and the community to tackle this problem. Whatever happens the effects of automation will be felt at every level of our society and to prevent it from being torn apart will require the commitment of expertise and resources on a scale probably not seen since the war. The big difference is that this problem certainly will not disappear after six years.



## REFERENCES

- (1) See ECONOMIC POLICY REVIEW, University of Cambridge Department of Applied Economics, No. 4, March 1978.
- (2) A National Institute for Economic and Social Research document, cited in *Youth Unemployment: A Background Paper*, Youthaid, Sawdon A., July 1977.
- (3) *Ibid.*
- (4) Quoted in Sawdon A., *op. cit.*
- (5) See statement by John Grant M.P. at an E.E.C. Commission meeting on work-sharing, *Shorter Working Week Mooted*, Palmer J., THE GUARDIAN, 22nd March 1978.
- (6) See Sawdon A., *op. cit.*
- (7) See MANPOWER SERVICES COMMISSION REVIEW AND PLAN 1977, Manpower Services Commission, November 1977.
- (8) See *Technical Change and Unemployment*, Freeman C., paper delivered to "Science, Technology and Public Policy": An International Perspective Conference, University of New South Wales, 1-2 December 1977, to be published in Conference Proceedings.
- (9) See *Economics of Industrial Innovation*, Freeman C., Penguin, 1974.
- (10) Freeman C., *op. cit.*
- (11) See *Towards Full Employment and Price Stability*, Report to the O.E.C.D., (McCracken Report), O.E.C.D., 1977.
- (12) See *How to combat the mounting threat to jobs*, COMPUTER WEEKLY, Sherman B., 23rd February 1978.
- (13) Personal communication with Mike McLean, 4th April 1978.
- (14) See *To work on a chip: the mixed blessing of miniaturisation*, THE LISTENER, 6th April 1978.
- (15) See *Electronic ambush of the stock market*, NEW SCIENTIST, Bond W., 11th November 1976.
- (16) See FINANCIAL TIMES, 13th May 1976.
- (17) See *Impact of CAD on the designer and the design function*, COMPUTER-AIDED DESIGN, Cooley M.J.E., Vol. 9, No. 4, October 1977.
- (18) See *Microprocessors, side-effects and society*, MICROPROCESSORS, Laver M., Vol. 1, No. 5, June 1977.
- (19) See *Point of Sale terminal systems* COMPUTER COMMUNICATIONS, Poole J., Vol. 1, February 1978.
- (20) *Ibid.*