

# Technological Change and Employment in The 1980s

Peter Robson

## INTRODUCTION

Views on the impact of technology on employment opportunities and the nature of work are becoming increasingly polarised as the economic recession deepens. Economists have influenced the mass of people to believe that the march of technology causes more and easier production, leading to more wealth which is equivalent to capital. More capital invested through advanced technology generates greater production which in turn creates more jobs. Countering this notion is the view which holds that in an economic environment of high unemployment and a stagnating economy, the balance between technology, capital and full employment is being irreversibly disturbed by the wholesale impact of automation and advanced mechanization. Designed on the basis of a further degradation of skilled work, these advanced technologies create fewer, more menial jobs for Australian wage and salary earners.

This paper argues that the latter position will hold unless well organized, counterbalancing forces such as the Australian labour movement are prepared and equipped to intervene. The paper analyses the nature of these technological developments and their effect on employment into the 1980s. The theory which maintains that the service industries are capable of absorbing job positions lost in the manufacturing and primary sectors is examined and viewed as highly questionable. This analysis shows that as these technologies are developed in a capitalist economy intellectual work will become more menial. Finally some views are put forward on the role which the labour movement might take to redirect these technological thrusts.

The tendency for technology to replace jobs is not a phenomenon that is unique to the 1970s and 80s. The introduction of tools throughout history has caused dislocation in employment and the nature of work. The bow and arrow changed the hunter's techniques of pursuing game. The wheel altered man's method of transportation. However it was Watt's steam engine, developed in the second half of the eighteenth century that brought about the massive employment dislocation and industrial upheavals that we know as the industrial revolution. A blossoming of new industries grew around this new source of motive power. Large textile factories were built in towns; potteries used steam power for grinding materials and turning of lathes.

The use of scientific technology, and the need for work-force control of the development of machinery, all required different forms of work organization than those existing with artisan and craft production processes. The division of work into small, discrete parts was the principle adopted for the organization of labour. However, it was not the new technologies that predetermined the division of labour but more the social and economic framework in which they were introduced.<sup>1</sup> Adam Smith's description of the division of labour in 'pin' manufacture illustrated some of the principles in the development of this form of work organization.

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Today, advanced mechanization and automation are, in themselves, blamed for the degradation of work in the 1970s. This is not the case. Technology can be changed both in its social usage and in the way work is organized in relation to it. It is the social and economic framework in which mechanization and automation is introduced that is producing fewer more mindless jobs.

A few academics and others associated with the labour movement have been highlighting the dire effects of technology for some time. They have been advocating that trade unions intervene on the nature and direction of advanced mechanization and computerization. This debate, which was substantially developed in the 1960s, dissipated into irrelevancy for those dealing with practical day to day trade union work. The computerization and automation of work processes did not eventuate to the extent that was predicted. While mechanization was accelerating, the economy was also expanding, creating alternate job positions, especially in the services sector.

Why, then, does a debate on technology and employment become relevant, if not imperative, in 1979? There are three major reasons - Firstly, the computer based, technological revolution has become of age and is impinging on all aspects of work in Australia. Secondly, advanced mechanization and automation is taking place in a stagnating Australian manufacturing sector. Encouraged by a 40% investment allowance, the installation of these machines is not designed purely to produce more goods but also to replace workers. Finally, the service sector which has historically absorbed displaced workers, is itself subject to the introduction of advanced technologies which reduce job positions.

#### THE TECHNOLOGICAL REVOLUTION

While various forms of computers were built before the twentieth century, it is generally recognised that the Harvard Mark I computer, completed in 1944, marked the start of what has become known as the 'technological revolution'. The first electronic computer called ENIAC was built in 1946. It contained 18,000 vacuum tubes and just fitted into a 20' x 40' room. Until the 1960s, computers continued to be costly, large and often unreliable. It was for these reasons that the promised 'computer revolution' did not occur. However, since then, the computer has tied in with revolutionary developments in communications and electronics and created a new breed of machines that perform very rapid routine operations or complex decision making tasks that are an extension of, or substitution for, the human mind.

The key feature of the Industrial Revolution was the substitution of mechanical power for that of man and animal. The technological revolution is creating implements which are self controlling under the direction of a computer. Here the key feature is the substitution of the intellectual power of humans with a machine. This process is often known as cybernation.<sup>2</sup>

In the last 15 years, the development in the field of electronics has been remarkable. It could be said to have been sparked off by the earlier development of the transistor. This forms the basis of modern electronic components, the integrated circuit which is developed by using semiconductor sandwiches similar to that of transistors. It was found that many 'transistors' could be placed adjacent on a minute piece of the material to work as a unit. Since this development in the early 1960s, continual refinement and improvement has taken place. This technology is the basis on which the mini computer has been developed.

The most recent development in this field is the microcomputer.<sup>3</sup> This is a very small computer with the central processing unit being the size of a matchbox. It is small in size but not in capabilities. Its compactness is achieved by the use of a single, central, integrated circuit (I.C.) which contains virtually all of the circuitry required to form the 'heart' of a digital computer. This single integrated circuit is called a microprocessor and is made using large scale integration (L.S.I.) techniques. It was developed in 1974, almost by accident as a result of "Intels" efforts to produce a calculator of unprecedented flexibility.

These recent changes in technology have dramatically increased the reliability, speed, and versatility of computers and the work process with which they are associated. They have also drastically reduced the cost of computers. A computing task which would have cost \$14.54 in 1951, costs 20¢ in 1976 without adjusting for inflation. The cost of computing has been reduced by a factor of 72 and the speed of processing has increased by a factor of 75.<sup>4</sup> This has occurred because of decreasing hardware costs and improved space utilization due to miniaturization. The memory of a 1952 computer would have required a 25 square house with 10 foot ceilings.<sup>5</sup> By 1976, this was reduced to one cubic yard and with micro technology will be reduced even further.

By the 1970s, all these factors had increased the usage of computers in Australia. Computer techniques have been introduced into production and process control and management information systems, but their greatest impact was in the tertiary sector where clerical functions were being performed by computers. Table 1 shows the influence of electronic data processing on finance, business services and wholesale and retail trade.

Table 1: Use of Computers - Private Non-Rural Sector.<sup>a</sup> Australia 31 December 1973.

	Enterprises with computers <sup>b</sup>		Enterprises currently making use of electronic data processing techniques. <sup>c</sup>	
	No.	%d	No.	%d
Mining	54	2.2	111	4.5
Manufacturing	1038	3.7	1838	6.6
Construction	41	0.1	218	0.7
Transport and communications	43	0.5	78	0.9
Finance, real estate and business services	533	2.5	2404	11.1
Wholesale and retail trade	1275	0.8	1844	1.1
Other services	72	0.2	717	1.5
<b>Total private sector</b>	<b>3057</b>	<b>1.0</b>	<b>7211</b>	<b>2.4</b>

a Excludes agricultural and pastoral enterprises, as well as all publicly owned or operated organisations.

b Enterprises with any digital computers installed (including equipment leased, rented, etc).

c Enterprises currently using electronic data processing or digital computing (including utilisation of service bureaux), whether the equipment is installed or operated in the enterprise or not.

d Proportion of total number of enterprises in sector.

Source: Structural Change in Australia, I.A.C. June 1977.

The increased market for minicomputers in the last half of the 1970s has seen their use in the manufacturing and tertiary sector in both large and small enterprises. Recent developments in 'time-sharing' and microcomputers are making electronic data processing accessible to quite small firms with a resulting extension of the effect of computer technology.<sup>6</sup> While there has been an annual growth of large computers of between 15 and 35%, the number of small computers is increasing at rates of at least 25% and up to 55%. It is predicted that the number of minicomputers installed throughout the world will increase tenfold by 1986.<sup>7</sup> The computer based technological revolution is a reality and will increasingly impinge on all forms of employment. The number of job positions available and the organization of labour associated with these new technologies will be irreversibly changed as it gathers momentum.

#### THE MANUFACTURING SECTOR, TECHNOLOGY AND EMPLOYMENT IN THE 1980s

From 1961 to 1971, the manufacturing sector declined only slightly in relative importance as a sector for employment. A relative decrease of 1% in this decade compares to a 4% increase in the service sector. However from 1971 to 1977 this position has changed dramatically as is shown in Table 2.

Table 2: Labour force sector percentages of total\* 1961 to 1977 (a).

	1961 census	1966 census	1971 labour force survey	1971 census	Feb 1977 labour force survey
Manufacturing	27.6	27.6	26.5	24.2	21.8
Agriculture, Forestry, etc.	11.1	9.6	7.9	7.7	6.5
Mining	1.3	1.2	1.4	1.5	1.3
Services & Others *	60.0	61.6	64.2	66.6	70.4
Total	100.0	100.0	100.0	100.0	100.0

\* Including public service employment

(a) The 1971 census results are not strictly comparable with those of 1966. The 1971 labour force survey results are however comparable with the 1966 census while the 1971 census results can be compared with the 1977 labour force survey.

Source: Australian Bureau of Statistics.

In these five years the relative decrease has been 2.5%, with manufacturing employing less than 22% of the total workforce in 1977. In the last few years, job positions available in manufacturing have also decreased in absolute terms. This has occurred not only in those sectors where the volume of manufacturing production has declined but also in those few areas where production has increased. Table 3 and Table 4 demonstrate these changes.

While it is impossible to separate the effects on employment due to economic restructuring and technological change, some important trends can be identified.<sup>8</sup> Since 1974, capital investment in manufacturing industry has increased from \$250 to nearly \$400 million per annum.<sup>9</sup> It has mostly been used to eliminate job positions. The reintroduction of the investment allowance two years ago has encouraged this process, irrespective of the current government's view to the contrary.<sup>10</sup> In a study<sup>11</sup> commissioned by the Department of Industry and Commerce

in 1977 on investment in Manufacturing Industry, the consultants had this to say on the issue -

In this environment (i.e. the current economic recession) manufacturers survived by reducing the unit costs of production and securing markets for a rationalised fixed asset base. The bulk of capital investment since 1974 has been directed at labour replacement with little investment in increments to capacity.

Whether this 'labour replacing' movement is in the form of mechanization or computer-based automation is not at all clear.

Table 3: Changes in manufacturing employment

	1974 February	1977 February	% change
Employment ('000) (a)	1352.5	1281.5	- 5.3
Employees ('000) (b)	1332.3	1177.1	- 11.6
Food, beverages and tobacco	202.3	194.3	- 4.0
Textiles	54.3	39.3	- 27.6
Clothing & Footwear	110.2	83.5	- 24.2
Wood, wood products & furniture	80.5	76.5	- 5.0
Paper & paper products, printing	107.1	96.5	- 9.9
Chemicals, petroleum & coal products	67.3	62.3	- 7.4
Non-metallic mineral products	53.5	48.2	- 9.9
Basic metal products	96.0	90.1	- 6.2
Fabricated metal products	119.8	106.1	- 11.4
Transport equipment	168.0	149.5	- 11.0
Other machinery & equipment	197.7	165.8	- 16.1
Miscellaneous manufacturing	75.5	65.3	- 13.5

(a) 'Labour Force Survey' - A.B.S.

(b) 'Employed Wage & Salary Earners' - A.B.S.

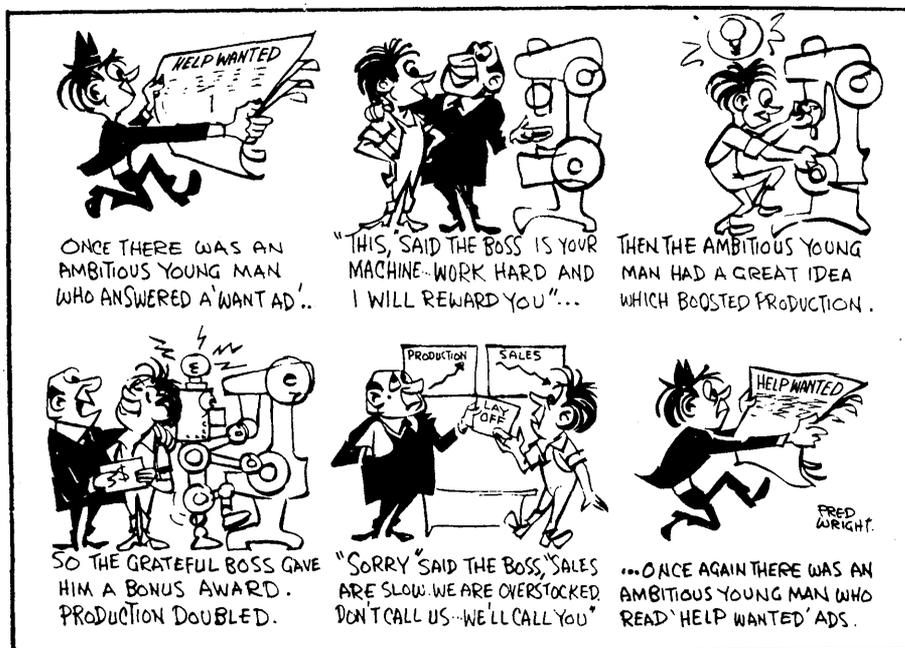


Table 4: Manufacturing Production: February 1974 and February 1977

	1974 February	1977 February	% change
All groups (excluding power)	164	154	- 6.1
Metals, machinery, appliances	139	123	- 11.5
Transport equipment	135	128	- 5.2
Building & construction equipment	174	161	- 5.8
Furniture & household goods	215	183	- 14.9
Textiles, clothing & footwear	147	127	- 13.6
Food, drink, tobacco	146	156	+ 6.8
Chemical & allied industries	265	270	+ 1.9
Miscellaneous	186	175	- 5.9

Source: ANZ production indices (seasonally adjusted).

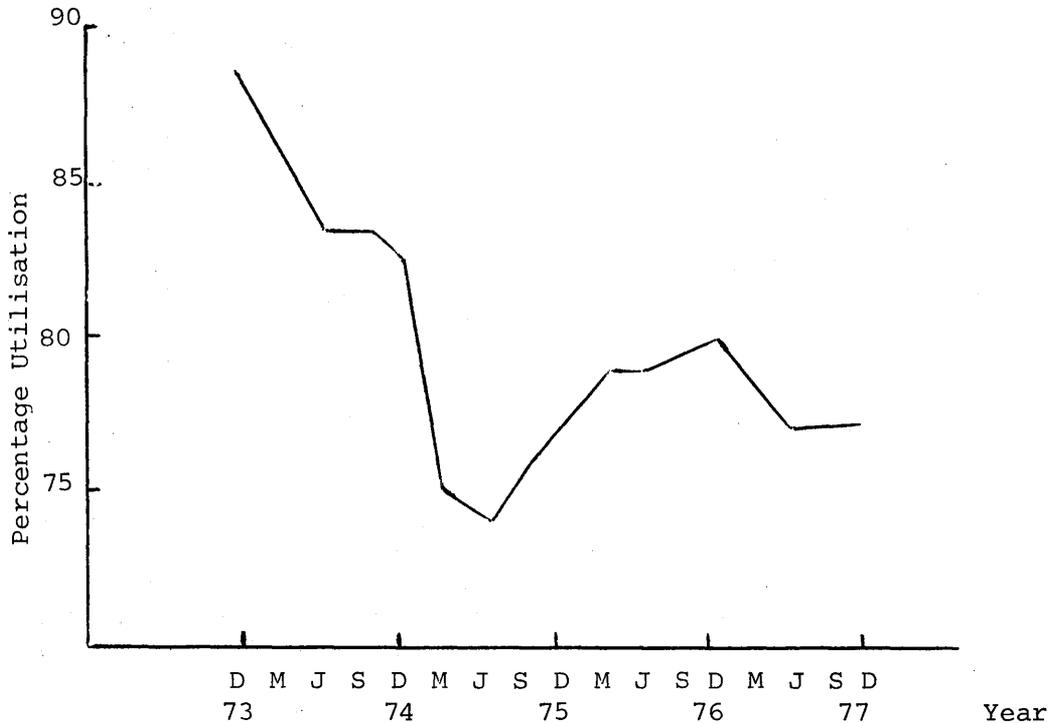
It is the view of the writer that much of technology being introduced in the production areas of process industries<sup>12</sup> is in the form of advanced mechanization or a combination of mechanization with small computers being used in a data acquisition or information phase.<sup>13</sup> While mechanization itself will eliminate job positions, the computer, used in this role, does not normally replace direct production operators. Indeed, if the data is supplied direct to the operator, his/her control over the production process is increased. However, the computer replaces workers associated with production such as process recorders and tally clerks.

In industries where work is organized on mass production or assembly lines, mini and micro-computers have already made much greater inroads. In conjunction with new equipment, or sometimes as an addition to existing machines, they are being used to control such components as transfer equipment, presses, machine tools and welding equipment. Moreover, in all parts of manufacturing industry, computers controlling packaging, warehousing and distribution machinery are being introduced not to better control the work process but on the basis of eliminating job positions.

The application of mini and micro-computers in manufacturing industry will expand rapidly in the 1980s.<sup>14</sup> With the size and cost of computers coming down and their versatility and reliability increasing they could be used in a controlling or cybernetic role. They will be so used if the computer companies and technocrats have their way. If this occurs the intellectual work that is being done by operators of machinery will be greatly contracted. The workers diagnostic ability will be handed over to the cybernetic machine.

This process is not inevitable. It depends on how the technology is applied and on the attitude that workers and their unions take in this introduction. This is crucially important because, unless something is done about reducing working hours, the number of job positions that the manufacturing sector will have available will continue to decline rapidly. This reflects, among other things, the tendency to excess capacity that already exists. This under-utilization of installed capacity is shown in Figure 1.

Figure 1: Utilisation of Installed Capacity



Source: Survey of Manufacturing Activity, April 1978.

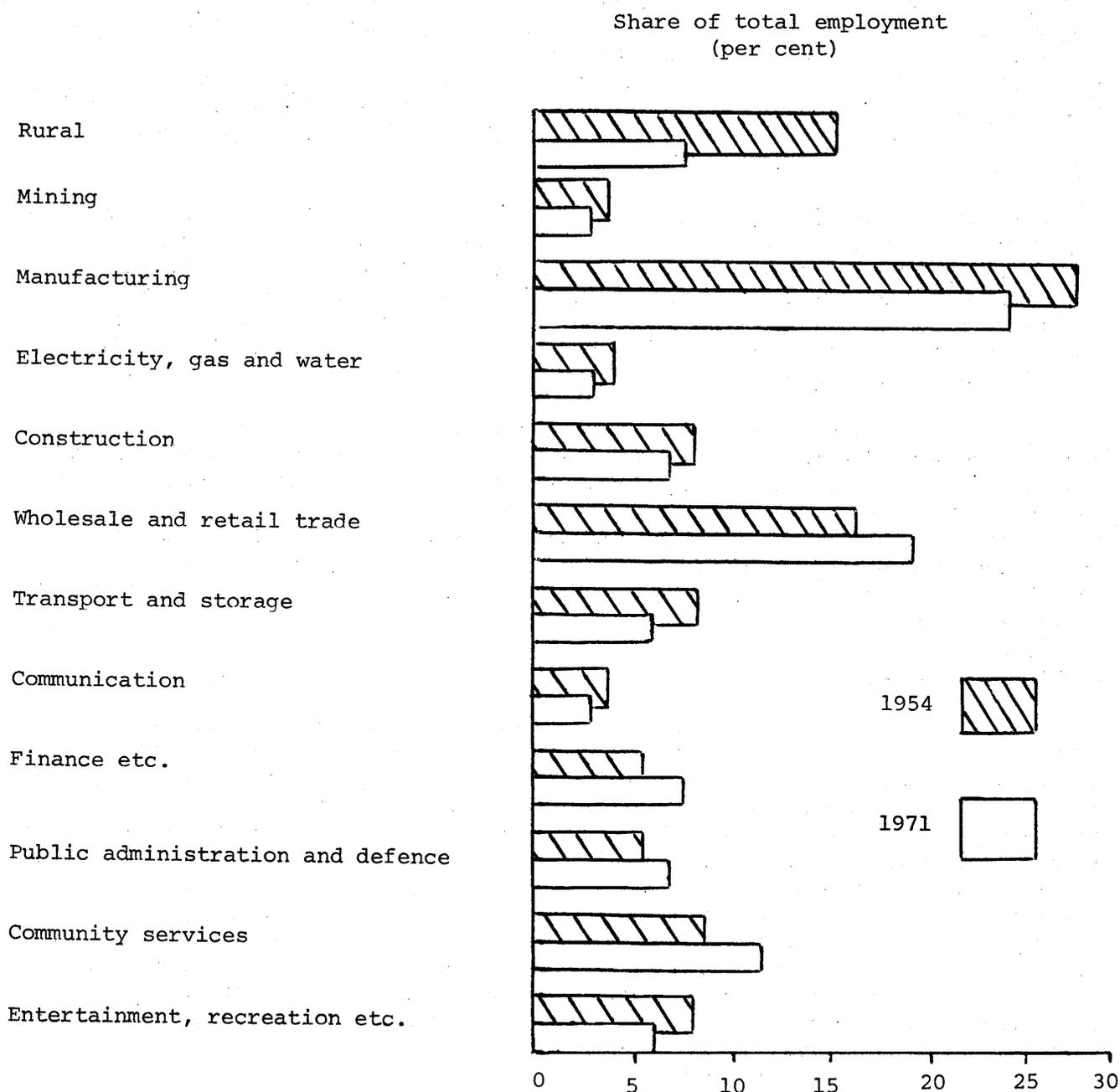
While investment is being directed towards job-replacement, it will not normally require additional people even if the economy eventually expands and capacity-utilization improves. This is especially true when small computers have been installed to control the work process. A good example of this trend is the petro-chemical industry. It can be seen from Tables 3 and 4 that, while production expanded between 1974 and 1977, the number of people employed reduced by 7.4%. This is a leading industry in the introduction of mini and micro-computers.

THE SERVICE SECTOR, TECHNOLOGY AND EMPLOYMENT IN THE 1980s

The reduction in the share of total employment in the rural, manufacturing and construction industries between 1954 and 1971 has been offset by the creation of extra job positions in the service sector. These changes are clearly demonstrated in Figure 2.

The industries that have particularly increased their share of total employment are Wholesale and retail trade, Finance, Public administration and Community services. The view, which held that as job positions were lost in the primary and secondary sectors new positions were created in the service industries, appears to be validated in the relatively stable economic period between 1954 - 1971. However, with the contraction of the manufacturing sector since 1974 and the large number of unemployed people, this relationship has not been maintained. The late 1970s has also seen the introduction of small computers into the work process of many industries in the service sector. Computerized warehouses in wholesaling, point of sales terminals in retailing, electronic funds transfer in banking, word processing systems in administration and computerized switching gear in communications are examples of these developments. The organization of work that has developed concurrently with these technologies has meant that jobs have been divided into smaller parts which has made them less interesting and subject to lower rates of pay.

Figure 2: Employment by Industry: Australia, 1954 and 1971



Source: Estimated by the I.A.C. from A.B.S., Census of the Commonwealth of Australia, 1954 and 1971

The introduction of these computerized technologies has meant that there have also been less job positions available. As with manufacturing industry, there are no official statistics to substantiate this view. However, the following examples from each of the major industries in the tertiary sector will illustrate this point.

Retailing

Research carried out in conjunction with the author in one major retailing chain

in N.S.W. showed that the first form of computerization was introduced fifteen years ago. The only machines previously used in stores were wooden cash registers. The only information available to central management was weekly sales. The local store manager and staff had a dominating role in running the store. They were required to sell, re-order stock, advertize certain lines, discount slow moving lines and decide on new products to be sold in the store. The sales assistant played a major part in these decisions and his/her job was seen as a career position.

The first phase of computerization was that of 'data collection'. Here N.C.R. registers are connected to a head office computer centralizing performance information from each store. This has meant that all purchases now originate from head office, advertising and sales promotions have been centralised. Now the main duties of the sales assistant are to dust the stock, wrap purchased goods and to keep smiling. Over this period, the number of stores in this particular chain have doubled to around 30 but the staff positions have been marginally reduced.

In the early 1980s, like other major retailers, the company intends to install computer terminal/registers or point of sale computer terminals. These combine mini and micro computer technology and, when associated with 'the supermarket' form of work organization, it leaves the sales assistant wrapping goods and operating the terminal. In addition to compiling all types of reports, the register controls stock levels, reorders, reads merchandise labels and credit cards. It is also capable of electronically transferring funds from a person's bank account to that of the retailer.

#### Banking and Finance

A recent report on the application of data processing in the Australian banking industry<sup>15</sup> over the next ten years showed that banks agreed they needed a national electronic money transfer system and that by the mid 1980s most paper movement would be channelled through electronic funds transfer systems. In addition, money dispensers and 24-hour automated teller services would be available in most Australian cities. Here, again, the application of micro and mini computers will radically change the nature and level of employment in the finance industry. For example, this system would enable an employer to electronically pay wages directly into an employee's bank account. Deductions would be automatically withheld from the transfer for items such as union fees, medical insurance, superannuation, etc. The person might then make a purchase from a local department store. Using a particular card, code or signature, he/she would authorise the required amount to be electronically transferred from his/her bank account to the store's account.

The changes in work organization of banking and the effect on job positions have not been determined. Unless the course of events are redirected by the intervention of banking workers and their unions, one could predict that banking work will become more narrowly defined and that there will be less job positions available.

#### Administration

Another major technological development in the finance and administration sectors is the rapidly expanding use of word processing systems. Word processors are small computers consisting of an electric typewriter keyboard, with a video screen; a storage station using magnetic tape, cards or discs, and a printer station for completion of documents. They are capable of recalling material requiring correction and making the desired correction independent of the rest of the document, re-checking and re-typing. Memory storage also means that form

letters can be produced and altered without re-typing.

In a recent article,<sup>16</sup> the Managing Director of Westaff Pty. Ltd., a big personnel agency, claimed that first generation word processing systems had displaced 20,000 typists in Sydney alone. In an address to the Institute of Industrial Engineers at Parkville, Vic., in March 1977, an officer from the Colonial Mutual Life Assurance Society Ltd., indicated that the introduction of 12 word processors had cut staff requirements in a CML Office from 100 Clerk typists to 29 operators and 2 supervisors. He detailed the cost savings involved. The only problems he conceded were the boring nature of the operator's task (job rotation was mentioned) and the problem of the executive losing 'his secretary'.

Word processing systems will have a substantial effect on employment opportunities in the 1980s and, if technologists and employers have their way, secretarial work will be reorganized along similar principles to that of a factory assembly line.

This analysis of the service sector of Australian industry has highlighted some major developments that are going to reduce employment opportunities in the 1980s. There may be new technologies that are employment-generating but, if so, their existence remains unpublicised. Even in a major growth sector like communications, the major employer, Telecom, plans to maintain constant staff levels into the 1980s even though business output is expected to increase substantially.<sup>17</sup>

The organization of work through the division of labour and the separation of intellectual and physical work is intervening into all service industries. What started as a trickle in the 1960s will become a torrent in the 1980s unless wage and salary earners through their unions are prepared to alter the course of this technological flood.

## CONCLUSION

The belief that "the march of technology causes more and easier production, leading to more wealth which is equivalent to more capital which, invested in the latest technology will lead to more jobs" is consistently proposed by many politicians, technologists and employers. This proposition will not hold true in the 1980s if those controlling government, work enterprises and the development of technology have their way. If they do, job positions will be further reduced in the manufacturing sector and there is every chance of this also occurring in the service sector.

The technological revolution developed in the social and economic framework of Australia will have tremendous impact in the 1980s. Unless checked and redirected it will contribute substantially to large numbers of blue and white collar workers being put out of work. It will also contribute to the deskilling and dehumanising of the jobs of those who remain.

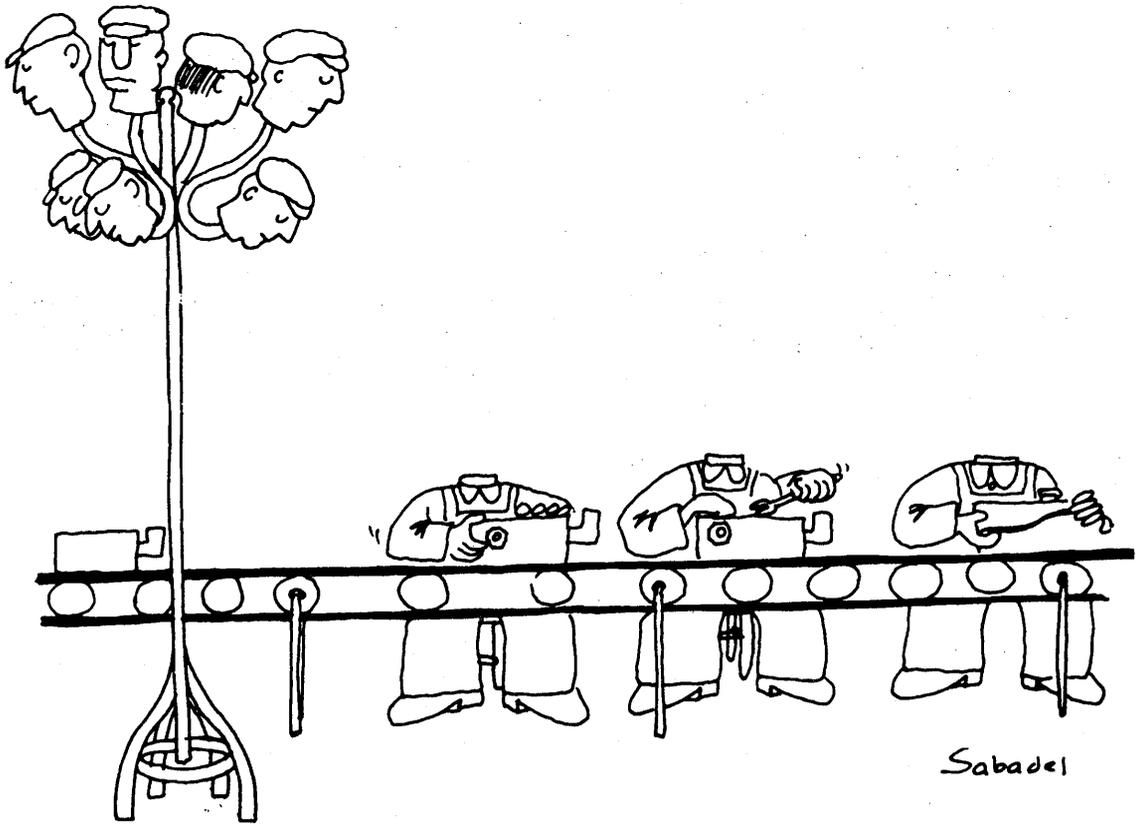
However, the degradation of work is not caused by these advanced technologies themselves. The division of labour as a form of work organization was implemented before the first industrial revolution and certainly centuries before the invention of the computer. It is the economic and social framework in which they are introduced that will fundamentally determine the organization of labour. If new computer based machinery is introduced on the basis of a cost/benefit analysis whereby workers are to be replaced by the machine then the organization of work will reflect this. There is no better example than the word processor. The technology itself could add greatly to the quality of secretarial work. However, introduced on the basis of reducing labour costs, job positions are eliminated and the organization of work reflects an assembly line mentality.

It is my view that wage and salary earners through their unions represent the only force that can intervene in and redirect the thrust of new technologies. They can ensure that job positions are retained and that the organization of labour improves wages, skills and the quality of working life. The labour movement encompasses that group of citizens that can redirect scientific technology so that it becomes accountable to the mass of people.

#### FOOTNOTES

- 1 This position is well developed by Harry Braverman in "Work and Unemployment", Monthly Review, June 1975.
- 2 Cybernation has been described as "a new philosophy of technology and a new way of analysing and organising and organising work; its importance is to create automatic information and control systems". See J. Rose, The Cybernetic Revolution, Etc. Science, London, 1974, p.17.
- 3 See, for example, "Microelectronics", Scientific American, September 1977.
- 4 A. Frazer, "The Small Computer System and the Accountant", The Australian Society of Accountants, 'The next five years in Computers', April 1978, p.5.
- 5 Ibid, p.3.
- 6 "Structural Change in Australia", Industries Assistance Commission, Canberra June 1977.
- 7 K. McGregor, "Computers 77", The Australian Financial Review, August 8 1977.
- 8 An important survey on employment and technological change was conducted by the then Department of Labour and Immigration in 1972. This survey analysed the loss of job positions by industry sector. Its last report was issued in 1974, viz. "Employment & Technology", National Survey of the Employment Effects of Technological Change, Australian Government Printing Service, Canberra, 1974. Since 1974, there have been no government statistics produced on the employment effects of technological change.
- 9 "Economic Indicators", Journal of Industry and Commerce, March 1978.
- 10 The treasurer, Mr Howard, responded to a question in Parliament on May 8, on the success of the government's 40% investment allowance in the following manner: 'In his reply Mr Howard said that he disagreed with those persons who argue that the investment allowance replaced men with machines. "I do not accept that over-all the investment allowance has been an adverse factor so far as unemployment is concerned." Mr Howard said. J. Hywood, "Government may extend investment allowance phase-out", The Australian Financial Review, May 9, 1978.
- 11 "Investment in Manufacturing Industry", Journal of Industry and Commerce, March 1978.

- 12 Process industries here refers to capital intensive continuous flow technologies such as exists in the steel, oil, glass, sugar and chemical industries.
- 13 In this phase the computer is used to gather information about the process and supply that information to operators or supervisors. It usually means that there is more information concerning the nature of the process which is often required before the computer can move into a controlling and diagnostic role.
- 14 The writer has been involved with oil industry unions in N.S.W. in research into the application of process computers into the Petrochemical industries. This industry sector has used computers for gathering data and supplying information about the process for some years. The companies are seeking to introduce combinations of mini and micro computers to take over controlling functions previously carried out by operators. Because of the advanced state of technology in this sector, this research has offered some practical experience as to what could generally occur in the 1980s.
- 15 "Nixdorf Report shows new challenge for Banks", Data Trend, September 1973.
- 16 A. Horin, "The Great Disappearing Secretary Trick", The National Times, April 3, 1978.
- 17 See "The Telecom Corporate Plan", December 1977, p. 57.



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