TECHNOLOGICAL CHANGE IN AUSTRALIA:
A REVIEW OF THE MYERS REPORT

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In the preparation of this review, I greatly benefited from discussions with my colleagues Jim Cassing, Malcolm Gray, Bob Gregory, Fred Gruen, Rod Maddock and Peter Scherer. We did not always agree, and responsibility for the views expressed in the paper is entirely mine.

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TECHNOLOGICAL CHANGE IN AUSTRALIA: A REVIEW OF THE MYERS REPORT

1. "...it appears that the major recommendations of the Myers Committee will be rejected by the government. Did the Committee and its Report deserve a better reception and a better fate?"

2. "The picture of gradual and easily manageable change is not a good guide to the future. I believe that the Committee did not appreciate the potential of the current state of technology, and they seriously, in fact grossly, underestimated the impact of likely future developments."

3. "They (the Committee) took an uncritical look at the past, and unquestioningly extrapolated this to the future."

4. "...it should be recognised that the Social Safety Net has big holes, and that its implementation would aggravate the discrimination against certain groups in the workforce, particularly teenagers and married women."

5. "The Social Safety Net... excludes coverage for perhaps the most important of displacement costs: loss of human capital and expense of retraining."

6. "Perhaps, the widespread recognition of the need to make special provision for future technological change is the opportunity to re-think the fundamentals of the Australian welfare system. This task was clearly beyond the scope of the Myers Committee. But, it is not too late to look at it again."

7. "Their treatment of personal privacy is typical of the overwhelming superficiality of the Report. The issue warranted a well-informed and intelligent analysis of the likely problems, and the effectiveness and desirability of various solutions, with specific recommendations for action. Instead, we are provided with two pages of perfunctory remarks, culminating in a nebulous recommendation which sets no goals, provides no criteria for achievement and assigns no responsibility for action. At best, it will give the naive a 'nice warm feeling'."

8. "A cynical view of the role of Committees of Inquiry is that they are designed to produce a large number of easily passed recommendations. Then the government can accept these and reject the more far-reaching recommendations, while maintaining that it has accepted the bulk of the Report. On this criterion, the Myers Committee performed par excellence."

9. "On the whole, the recommendations of the Committee are an innocuous potpourri of good wishes and pious thoughts."
TECHNOLOGICAL CHANGE IN AUSTRALIA: A REVIEW OF THE MYERS REPORT

The Committee of Inquiry into Technological Change in Australia, (the Myers Committee) was appointed in December 1978, to "examine, report and make recommendations on the process of technological change in Australia". Their report, released in July 1980, was greeted with little enthusiasm, and it appears that the major recommendations of the Myers Committee will be rejected by the government. Did the Committee and its Report, deserve a better reception, and a better fate?

In attempting to answer this question, this review essentially follows the organization of Volume I of the Report. Section 1 considers the "benefits" of technological change, and Sections 2 and 4 are devoted to the "costs" of change. The cost foremost in people's minds concerns the impact on employment, and the Committee's investigation of the employment effects is analysed in Section 2. The most publicised recommendation of the Committee - the Social Safety Net - was designed to ameliorate the employment impact of technological change. It is discussed in Section 3. Section 4 is devoted to the other effects of technological change, and Section 5 to the other recommendations of the Committee. Concluding remarks are given in Section 6.

1 The full terms of reference are reprinted in an appendix.

2 Volume I contains an overview of the Committee's research, discussion of its findings, and its recommendations. Volume II surveys likely technologies in Australian industry. Volume III contains a review of government policies and programmes. Volume IV publishes a selection of the studies commissioned by the Committee. Since the Committee clearly relied very heavily on these studies, and they are published with the Report, I have regarded them as an integral part of the Report for the purposes of this review.
Although significant and far-reaching technological change will occur in biology and medicine, in agriculture, in materials and engineering, the most important area of technological change is certain to be in the development and use of microelectronics. This is also the area of my interest and experience. For these reasons, microelectronic technology receives more attention than other technologies in this review.

1. The Benefits of Technological Change

The Committee identified the benefits of technological change as being the promotion of economic growth and the maintenance of international competitiveness. Let us consider each of these in turn.

(i) Technological change and economic growth

By definition, technological change leads to economic growth (in a closed economy). It enables an economy to produce a larger output with the same inputs. In other words, technological change corresponds to an outward shift in the production function.

While this is generally accepted, the Committee felt that the establishment of the link between technological change and economic growth was so important that two of the commissioned studies (Kasper [1980] and Lydall [1980]) were devoted to this issue. The conclusions of these studies were readily adopted by the Committee.

Kasper and Lydall review the traditional evidence on the contribution of technological change to economic growth, in particular the work of Denison [1962], [1967]. Kasper presents evidence that the contribution of so-called 'third-factor growth' - the unexplained residual - in Australia over the
period 1950-51 to 1978-79 was 35% of overall growth. This is somewhat lower than the United States (44%), and much lower than the European countries (53-74%). No endeavour is made to explain the anomaly of the Australian experience.

More troubling, the growth accounting approach has experienced some difficulty in explaining recent economic performance. In the most recent account by Denison for the U.S., the contribution attributed to advances in knowledge, i.e. technological change, is actually negative. Table 1 shows the relevant figures.

Prior to 1973, the data support the conventional view. The growth rate is substantially higher in the period 1948-73 than in the earlier period 1929-48, and a large proportion of the faster growth can be attributed to a faster pace of technological change.\(^1\) If we apply the same method to the most recent period, 1973-76, then the contribution of technological change to growth has been negative.

Given the weight placed by the Committee on Denison's estimates and methodology, it is surprising that his latest work (Denison [1979]) receives no mention in the Report or in the commissioned studies. Comparable estimates for Australia are not available, but the evidence does suggest that Australia experienced a similar productivity slowdown. This is shown in the following estimates, obtained from the commissioned study by Kasper [1980].

---

\(^1\) Growth in the postwar period is .91 percentage points higher; the amount attributed to technological change is .65 percentage points. Therefore, in the growth accounting sense, 71% of the increase in postwar growth over the earlier period can be attributed to technological change.
<table>
<thead>
<tr>
<th></th>
<th>1929-48</th>
<th>1948-73</th>
<th>1973-76</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth Rate</td>
<td>1.21</td>
<td>2.12</td>
<td>-0.22</td>
</tr>
<tr>
<td>Total factor input</td>
<td>0.25</td>
<td>0.60</td>
<td>0.44</td>
</tr>
<tr>
<td>Output per unit of input</td>
<td>0.96</td>
<td>1.52</td>
<td>-0.66</td>
</tr>
<tr>
<td>Attributed to:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Improved resource allocation</td>
<td>0.28</td>
<td>0.29</td>
<td>-0.01</td>
</tr>
<tr>
<td>Legal &amp; human environment</td>
<td>0</td>
<td>-0.04</td>
<td>-0.34</td>
</tr>
<tr>
<td>Dwellings occupation ratio</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>Economies of scale</td>
<td>0.21</td>
<td>0.32</td>
<td>0.19</td>
</tr>
<tr>
<td>Irregular factors</td>
<td>0</td>
<td>-0.14</td>
<td>0.07</td>
</tr>
<tr>
<td>Advances in knowledge</td>
<td>0.45</td>
<td>1.10</td>
<td>-0.59</td>
</tr>
</tbody>
</table>

Source: Denison [1979], Table 8-3, p.108.
TABLE 2
Productivity Growth Rates in Australia

<table>
<thead>
<tr>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Growth rate in GDP per</td>
<td></td>
<td></td>
</tr>
<tr>
<td>person employed</td>
<td>2.4</td>
<td>0.9</td>
</tr>
<tr>
<td>Growth rate in output</td>
<td></td>
<td></td>
</tr>
<tr>
<td>per unit of input</td>
<td>3.1</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Most recent experience, therefore, seems to undermine the case for a strong direct link between technological change and growth, which the Committee took great pains to establish.

Can we explain the recent productivity slowdown in a period of rapid technological change? Two important factors identified by Nelson [1979] provide at least a partial answer. First, the sources of growth are not independent and additive, as assumed in Denison's work. In particular, technological change and investment in capital are strongly complementary. Technological change keeps the rate of return high and investment attractive, whereas new technology must frequently be embodied in new capital. Therefore, the recent productivity slowdown is due in part to the depressed state of output growth and in particular, by a reduced growth rate of investment.

That this is the case in Australia is supported by the estimates of factor input growth provided by Kasmer [1980]. These are given in Table 3.
Comparing the periods 1950/51-1973/74 and 1973/74-1978/79, the growth rates of both capital and labour declined, the deceleration in capital input being quite marked. The slower growth of capital could have a significant retarding effect on the rate of implementation of technological change. This interpretation is strongly reinforced by the third row of Table 3, which distinguishes that component of investment comprising private plant, equipment and structures, as distinct from dwellings and government investment, which is more likely to embody new technology. In the latter period, the growth rate of private equipment and structures is less than half that in the former period.

The greater relative deceleration in capital rather than labour input also helps to explain another feature of Table 2, that is the greater decline in labour productivity (Row 1) compared to total factor productivity (Row 2).

The second factor identified by Nelson is the observation that productivity growth rates are very different across sectors. The shift of resources from low to high productivity growth sectors was probably a major contributing factor in postwar growth. Equally, much of the recent slowdown in productivity change might be attributed to the increasing relative importance of sectors characterized by low price and high income elasticity of
demand, and by low productivity growth rates—such as personal and government services.

The relevance of this discussion is twofold. Firstly, to the extent that interdependence of growth sources and sectoral differentials in productivity are important determinants of the overall growth performance of the economy, their omission in growth accounting undermines its value in estimating the role of technological change. Hence, a major plank in the Committee's case is impaired. More important, though, is the relevance of these factors for the policy debate. For example, taking full advantage of the potential of technological developments requires a healthy growth rate of output, and high levels of investment. Technology policy cannot be divorced from macroeconomic policy.

"Too few economists, and fewer laypersons, appreciate the strength of the connection between output growth and productivity growth, not only in the economy as a whole, but industry by industry." (Nelson [1979], p.87).

Intersectoral differentials in productivity imply that structural adjustment, and the resultant reallocation of resources, results from the very process of economic growth, and not just from technological change.

"And one recognises as well why growth is a painful process which, while generating gains on the average, doles out losses to workers and capital in declining industries." (Nelson [1979], p.71).

Of course, technological change aggravates the process of structural adjustment. But, eliminating technical change will not eliminate the need for structural change, and the resultant gains and losses to different groups. This is a point which could have been stressed by the Committee and wasn't.
Technological change and international trade

The second plank in the Committee's case for technological change is that it is necessary for the maintenance of international competitiveness. Their analysis of the interaction between technological change and trade is far from clear. The spirit seems vaguely reminiscent of the mercantilists. Let me first suggest briefly what they should have said.

1. The impact of technological change on the volume of trade and on the exchange rate is ambiguous. Therefore, a prohibition on technological change does not necessarily imply a reduction in trade. Trade is based on comparative advantage, not absolute advantage.

2. Technological change in traded goods production brings about differential gains and losses, just as in the non-traded sector. For example, a technological change which lowers costs in the import-competing sector will reduce imports, leading to an appreciation of the currency, with ceteris paribus a resulting loss to the export sector. Technological change in an open economy will certainly not lead to a Pareto improvement.

3. In a closed economy, technological progress always increases national income. In an open economy, this is no longer true. Immiserizing technological progress can occur in a large economy due to a consequent adverse movement in the terms of trade (Bahgat [1958]), or in an economy with tariff protection (Corden [1974]). For a large economy, it is possible for the terms of trade to move against the country sufficiently to outweigh the favourable wealth effect, leading to a deterioration in real income. The world as a whole is better off, but the exporting country is not able to capture the benefits, except by resorting to tariff policy. For a country with tariff protection, "capital accumulation or technical progress may expand the production possibilities but the cost of protection may rise so much that real income actually falls" (Corden [1974], p.325).
4. Moreover, trade aggravates the structural change necessary following technological change. In other words, the factor movements resulting from a technological change in traded goods industry will be greater than if that good were not traded. Conversely, a technological change adopted by a trading competitor will cause a magnified structural adjustment in the domestic industry.

I think that it was this latter point which the Committee had in mind. Given that a more efficient technology is adopted by competitors, magnified structural adjustment can be avoided if the domestic producers adopt the same technology. Clearly, the relationship between trade and technology is more complicated than this.

In summary, then, international competitiveness is not an additional benefit of technological change. It is simply another aspect of the link between technological change and economic growth and welfare. Technological progress in a trading nation creates the same problems of winners and losers as in a closed economy. Far from creating a new imperative for technological change, trade magnifies the structural adjustments initiated by technical progress.

(iii) Much ado about nothing

The Committee's case for technological change is poor on two counts. Their analysis is weak, and they have addressed the wrong issues. Their analysis of the link between technological change and economic growth is superficial, and is not supported well by the most recent experience. Their analysis of the interaction between technological change and international trade is inadequate and confused. It should not stand alone as an additional goal; rather it is a concomitant of the objective of economic growth.
More importantly, the Committee has addressed the wrong issue. Opponents of technological change do not argue that technological change retards growth. Rather they oppose the fruits of that growth. The real issue of the benefits of technological change is the desirability of growth itself, or at least the type of growth that springs from expected technological developments.

Over the last decade, the prospects for and desirability of growth have been the subject of considerable debate - a debate in which economists have played a prominent role.¹ In its turn, the Myers Committee devotes almost two pages of its report to the desirability of growth, concluding:

The Committee, while far from being in favour of economic growth at any cost, believes that a high level of economic growth is desirable because it allows more choices for individuals between leisure and consumption and for governments between collective and private goods. A higher level of economic growth also allows greater scope for the redistribution of income and wealth through established political and industrial processes. (I, p.65)

Unfortunately, these banal remarks will do little to reassure those who genuinely fear that technological progress is not the wide road to the promised land.

Anti-growth arguments can be roughly divided into two camps. The first of these, the physical limits to growth school, argues that present growth trends cannot continue for much longer because the earth's resources and capacity to absorb pollution are limited. After initial prominence, the physical limits to growth argument has gradually fallen out of fashion. It has not yet been appreciated, however, that the development of microelectronics undermines its very foundations. Microelectronic components are extremely frugal in resources, and miserly in their use of energy. Moreover, they can be used effectively to optimize energy consumption in other

systems, such as home heating control systems and motor vehicles. They offer renewed hope for controlling pollution. For example, microprocessors have already been used successfully in auto engines to reduce exhaust emissions by optimizing engine performance. Microelectronics will not render the notion of physical limits to growth obsolete. But, it will demand a thorough reassessment of the evidence.

The second line of anti-growth argument is not disposed of so easily. It takes various forms and has many different proponents. But, the essence of the argument is that economic growth does not, or will not, lead to increased human welfare in the affluent nations. While not denying that growth brings higher real incomes, proponents point to surveys which show that people are not "happier" or "healthier" than previously, and to evidence of increasing congestion, mental stress, and crime.

The limits to growth are therefore social, rather than physical, according to Hirsch [1976]. He argues that economic growth leads to an increasing divergence between individual and collective rationality. It is now well accepted in economics that when economic activity has a social character, for example with public goods and externalities, individual interest does not promote social interest, and collective action is required. But, writes Hirsch, an important structural characteristic of modern economic growth has been neglected:

The structural characteristic in question is that as the level of average consumption rises, an increasing portion of consumption takes on a social as well as an individual aspect (Hirsch [1976], p.2).

As the proportion of social consumption rises, the divergence between individual and collective rationality expands, and the degree of suboptimality of the unfettered pursuit of private interest increases.
Over an increasing sphere of economic and social activity, action taken by individuals in response to their own preferences and needs in the situation they face has become an inefficient or ineffective way of achieving the objectives on which these actions rest. The social rationale of individual maximization weakens as the proportionate importance of public goods grows and social scarcity becomes more pressing. (Hirsch [1976], p.176).

While recognising the problems posed by externalities, economists have regarded them as largely peripheral. Hirsch argues that (a) they are central and (b) they are exacerbated by economic growth. In this way, he explains the paradox of affluence - that increasing affluence has not led to increasing satisfaction. He also elucidates the modern predominant concern with distribution and the increasing concern with collective provision and state regulation - "reluctant collectivism".

Hirsch captures the essence of many of the fears underlying opposition to technological change - fears that technological progress will not increase satisfaction and "happiness", and apprehension that technological change will transform society in a direction which promotes neither welfare nor freedom - the 1984 syndrome. These misgivings are not unfounded. Microelectronic technology and computerization prodigiously enhance the potential of government authorities and others to monitor and control individual activities and to prescribe and regulate behaviour.

At the same time, technology will expand our ability to account for externalities in decision making, to take account of varied preferences, and to tailor social institutions to individual circumstances. Together with increasing leisure time, it will expand the scope of collective as against individual decision making, by substantially reducing the costs of participation and communication. The impact of future technology is not entirely salutary, nor utterly deleterious; it is ambiguous. But these are the real issues at the heart of public concern, not the quantitative link
between technology and growth in the postwar years.

2. The Employment Effects of Technological Change

Undoubtedly the most controversial aspect of technological change is the potential impact on employment. Indeed, the inquiry originated out of an industrial dispute, and it might be said that the Inquiry's mission was to reassure labour that employment effects would be manageable and undramatic.

The employment effects of technological change can be considered on two levels: (1) at the micro level, the level of the individual firm, and (2) on the macro level, the economy as a whole. This corresponds roughly with the Committee's division into direct and indirect effects.

(i) The micro impact

The impact of technological change on employment in an individual firm or industry can be divided into:

- substitution effects
- scale effects
- skill and other effects

The most visible consequence of technological change is the substitution effect, where new machinery is substituted for labour, or one category of labour is substituted for another. Most frequently, the increased productivity enabled by the technological change must be obtained through some degree of capital/labour or labour/labour substitution. For some categories of labour (e.g., computer programmers), the substitution effect could be positive. For workers associated with the old technology, it is negative.

If the increased productivity resulting from the technological change is reflected in lower prices, demand for the product of the firm will increase. Technological change can then lead to a higher output than otherwise would
have been produced, with consequently higher employment. This is the scale effect, and it is always positive.

The scale and substitution effects of technological change on employment relate to the numbers of jobs. But technological change can have many other effects on work and the workplace. For example, the introduction of computer equipment is often associated with redesign of the work environment, provision of air conditioning, and so on. Technological changes can lead to changes in working hours (for example, night shifts) and in the ratio of part-time to full-time employment. Perhaps most important, technological changes often involve the enhancement or degradation of skills.1 'Deskilling' is one of the major popular concerns with technology.

Clearly, the skill effect has both a micro and a macro aspect. The case studies made by the Committee show that transfer of employees to a job with lower skills within the firm is one way of avoiding retrenchment. Equally, the introduction of technological change is frequently the occasion for employees to move into jobs demanding higher skills, for example, from clerk to computer programmer. Whether these changes in job content at the micro level are skills effects or substitution effects seems to me to be largely a semantic issue. More relevant for society as a whole is the question of whether technological progress leads to an overall increase or decrease in the level of skills over time. I will return to this issue below.

To assist it to evaluate the employment effects of technological change, the Committee commissioned case studies in more than seventy enterprises, including 2:

1 The distinction between a 'skill' effect and a 'substitution' effect is ill-defined. When does a more skillful job become a different job?

2 These studies marked with an asterisk are published in Volume IV.
- wordprocessor usage in two insurance companies, ten legal practices, three accounting firms and five other business organisations
- wordprocessing in the finance industry
- introduction of computerized point-of-sale terminals in a major retail store network
- computerized photo-typesetting in the Australian newspaper industry
- computerization of the South Australian TAB
- computer-aided manufacturing in twenty-one companies in the metal-working industry
- automated warehouses and abattoirs

The Committee also commissioned national surveys of the use of computers in local government and small businesses. In addition, the ABS, on behalf of the Committee, conducted a national survey of the introduction of technological change in non-farm enterprises over the 3-year period to 30 June 1979, and the employment effects of these changes.

The major findings of the ABS Survey were (in summary) (p.57-8):

1. More than 75% of the large firms (75 employees) introduced some technological change, while only 19% of the small enterprises did so.
2. A majority of these enterprises considered that their employment at 30 June 1979 would have been about the same without the technological change. Of the remainder, a larger group felt that the technological change had lead to lower employment than might otherwise have been. Only 10% of the large enterprises felt that the technological change they introduced lead to higher employment (in that enterprise).
3. Only 16% of the large and 7% of the small enterprises that introduced technological change actually retrenched surplus employees. Most relied on natural wastage (i.e. attrition, retirement, etc.) to avoid the need for retrenchments. That is, the employment impact was on potential entrants, rather than existing workers.
4. 76% of all those surveyed considered that technological change of all kinds had no significant effect on the numbers of persons they employed.

This rosy picture of the employment impact of technological change is confirmed in general by the surveys of local government and small businesses, and by the case studies. However, the case studies put some meat on the bare statistics, and provide some notable exceptions to the general rule.

Most employers involved in the case studies avoided any need for retrenchment by the process of 'natural wastage' and/or shifting employment within the organization. Many firms maintained that employment would have been much lower had the technological change not been introduced. That is, the scale effect contingent on not introducing the technological change (and keeping up with competitors) would have been very large.

The impact on skills and other aspects of work content was much more variable. Many of the employees affected by the introduction of word processors welcomed the challenge and the novelty of new skills to be learned. Others, even in the same firm, felt that word-processing lacked the challenge and variety of traditional secretarial work. Although word processor operators are currently regarded as belonging to an elite, it was generally felt that their career opportunities were inferior to those of a traditional secretary-typist.

Like all technological change, the introduction of wordprocessing affects the work environment of employees other than those operating or displaced by the new equipment. The introduction of word processing was frequently accompanied by a reorganization of the typing function within the organization. The typing function was often centralised in a wordprocessing center, with a resultant loss of personal contact. Many executives lost their
personal secretaries.

Another example of non-quantitative employment effects occurred with the introduction of the point of sale terminals in the retail store network, which brought about a significant redistribution of influence in the organisation: from older employees to younger, from customers towards operators, from store and department management towards central management.

More profound were the changes brought about by the computerization of the South Australian TAB. The range of tasks performed by sellers was considerably reduced. The responsibility and authority of agency managers was drastically cut. Positions were reclassified, reflecting a reduction in responsibility and status, and pay rates were lowered. Most of the affected staff were casuals, and the necessary reduction in labour was achieved principally by a reduction in hours of 50%-80%. Clearly, the TAB workers were "losers". Their hours were severely cut, their pay scales for normal hours were reduced and the intrinsic interest of the job was greatly diminished.

Another outstanding exception to the sanguine picture concerns the the newspaper industry. The conjunction of photocomposition with computer technology enables the input of printed material into the system by the originator (the journalist), and its automatic translation into the format of the printed page. Many skilled printing trades, such as compositors, readers and linotype operators were no longer in demand. Special skills, gradually acquired through apprenticeship and experience, suddenly became obsolete.

On the whole, no sharp picture emerges. The employment effects of technological change vary from case to case, and even different people within the same organisation give contrasting accounts. In most cases, the substitution effect was not large, and certainly not as large as some of the
more strident predictions. However, in two cases, the South Australian TAB and the newspaper industry, the substitution effects were very large. Generally, the scale effects were also small. Again, there were exceptions to this rule also. But, in the two cases with large substitution effects, the TAB and the newspaper industry, no scale increases offsetting the substitution effect were evident. The impact on skills is equally cloudy. This is partly because worker substitution was frequently avoided by transferring displaced employees to more or less skilled jobs within the same organisation. On balance, the case studies and the surveys portray a relatively sanguine picture of marginal changes at the micro level. How valid is this perception for the future?

(ii) A prospectus for the future?

A difficulty with using case studies to analyse the impact of technology on employment is that one can find a case study to support any generalisation one cares to make (Freeman [1979], p.103). The case studies summarised in the report demonstrate this well.

Another difficulty with case studies is that they tend to unquestioningly extrapolate past experience into the future. This is clearly demonstrated by the study of the impact of wordprocessors. Fully 83% of the wordprocessors in use in the small business and local government survey were memory typewriters (Lamberton [1980], p.43). Most of these were magnetic card units, available in Australia since the 1960's. They have much more in common with electric typewriters, than with currently available microprocessor-based word processing systems, which have considerably greater power and flexibility. Moreover, an important advantage of wordprocessing systems is the ability to integrate them with other office systems - telecommunications, financial records, information storage and retrieval (filing) and so on. This greatly
enhances the potential productivity of wordprocessing systems, and will strongly encourage their use. Yet, there is no evidence that any of the firms surveyed had even begun to realise the potential of wordprocessing.

Furthermore, it is reasonable to expect considerable progress in the near future on the implementation of voice and handwriting recognition. This would enable the originator (author) to input material into the system directly in the form in which he/she usually transmits it to the typist. The strictly typing function would be eliminated. The impact on employment would clearly be very different from that arising from the introduction of automatic typewriters.

Another example of the unreasoning extrapolation of past experience occurs in the commissioned study of computer assisted manufacturing (CAM), by McPhersons Research and Development Pty Ltd [1980]. They predict that there will be about 150 new implementations of CAM per year over the next ten years; that is, 1500 new implementations by 1990. On the face of it this would appear to be absurd.

The major factor identified by McPhersons as retarding the growth of CAM is the cost of equipment. But recent developments in electronics will largely remove that impediment. The history of electronic technology over the last decade or so has been one of exponentially increasing capacity coupled with exponentially decreasing cost, which will drastically alter the calculus of economic feasibility. The quintessence of this development is the microprocessor, which comprises a flexible and general-purpose computer on a single silicon chip. The microprocessor is only a little over five years

1 Specifically their estimate refers to numerically controlled machine tools, the simplest and by far the most prevalent form of CAM today.
old, and it cannot have had much impact on the implementations surveyed by
McPhersons, since the applications are only now becoming available. In the
near future, cost will not be a major impediment to the extension of CAM. To
predict 150 new implementations of CAM per year in Australia in the mid to
late 1980's is unbelievable.

It has often been argued that the application of microelectronics will be
slow because the rapid cost decreases apply only to the electronics, and that
the other parts of any application (eg hardware and power supplies) are
becoming increasingly expensive. Since the electronics currently form only a
small part of a total system, the overall cost will not decrease or will
decrease only gradually (I, p.13). Professor Myers (1980) made this point in
projecting a relatively slow growth of the use of wordprocessors. He
indicated that a wordprocessor, in addition to a microprocessor, requires disk
drives, a keyboard, a visual display unit (VDU) and a printer. These
components are (currently) expensive. Superficially, this argument appears

1 The first microprocessor was developed more or less by accident in the
early 1970's by a small corporation, Intel. One of the most popular
microprocessors, the 8080, was introduced by Intel in 1974, selling for an
economical $350. They are today available in a retail store in Canberra
for $6.50, and the wholesale price dropped as low as $2.75 in 1978. In
the meantime, new, more powerful microprocessors have been introduced at
competitive prices. While microprocessors have been the most visible
products of electronic development, other components - such as memories,
logic and interface chips - have also benefitted from the twin trends of
increasing capacity and decreasing cost.

2 Any household with $995 can today purchase a computer controlled sewing
machine, and Black and Decker recently announced the availability of a
range of computer controlled hand and bench tools, priced from $50 to $170
albeit unsophisticated ones. These are clearly numerically controlled
machine tools, (Newsweek, 13 October 1980, p.3).
knowledgeable and prudent. In fact, I believe, it is ill-informed and myopic. The reason is partly electronic, but mainly economic. The argument overlooks two principles of economics—substitutability and economies of scale.

It is true that mechanical components, such as disk drives and printers, are comparatively expensive in their current form. But it has now become economically feasible to substitute sophisticated electronics for these simple mechanics. For example, the printing mechanism can be controlled by its own microprocessor, and the disk drives replaced by bubble memory. The significance of the "microelectronic revolution" is not just that current electronic subsystems can be replaced with cheaper, faster and more reliable electronic components. It means that previously non-electronic subsystems can be replaced by sophisticated but cheap electronic components. Even for existing products, potential price declines are not limited by the currently high cost of the mechanical components. Moreover, cheap electronics will enable tasks to be done by completely new products which previously would have been economically unfeasible. For example, it is now possible to replace a keyboard with a completely solid state unit with no moving parts at much cheaper cost. But, the development of voice recognition for computer input would obviate the need for any keyboard at all.

The second factor which is often overlooked is the potential of price reductions due to economies of scale (which is the major reason for the low prices of the electronic components). A principal reason why mechanical and support systems are relatively expensive is because they are produced in small quantities. With widespread use will come economies of scale in their manufacture. This has already begun.1

1 Floppy disk drives currently cost about $400-$500. Eighteen months ago, the major manufacturer, Shugart, was reported to have signed an agreement with Matsushita of Japan to produce a disk drive to sell for $1850 in quantity (BYTE, July 1979, p.99). Letter quality printers now cost $2,000-$3,000. A product with a price of $250 has been rumoured (BYTE, Sept. 1979, p.115).
The combination of substitution of electronics for mechanics and economies of scale in production and distribution can confidently be expected to ensure massive price reductions in the applications of microelectronics. The resulting cost incentives will inexorably ensure their widespread acceptance. Professor Myers [1980] suggested that the word processor will always have a significant cost disadvantage compared to the modern electric typewriter. I think three years will show his judgement to be very wrong.

In this regard, it is instructive to compare the current prices of electronic and mechanical (electric) calculators, if the latter can still be found. The remarkable history of electronic calculators provides many indicators for the future use of more sophisticated electronic technology. Surprisingly, it gets no mention in the Myers Report.

The aim of this section has been to demonstrate that the extensive case studies and surveys undertaken by the Committee are not, taken as a whole, a reliable guide to the impact on employment of future technological changes. The picture of gradual and easily manageable change is not a good guide to the future. I believe that the Committee did not appreciate the potential of current state of technology, and they seriously, in fact grossly, underestimated the impact of likely future developments.

For this reason, the cases of the newspaper printers and TAB workers are more relevant for the future than the experiences of the wordprocessor or machine tool operators. The important lesson of the former cases is that certain skills become completely obsolete and the demand for other skills declined drastically. This of course is nothing new. What is new is the pace of change. There are two reasons why employment opportunities will change much faster in the near future than they have in the past. First, change in some industries will be more rapid, because of the nature of the changes. For
example, one cannot introduce electronic funds transfer (EFT) bank branch by bank branch. It has to be instituted in the system as a whole. Second, more industries and occupations will experience fundamental technological changes per unit time. Occupations which seem to be on the verge of significant technological change include bank employees, postal workers, shop assistants, typists, accountants, watchmakers and repairers, to single out only a few.

This is certainly not another prophecy of doom. I strongly agree with the Myers Committee that such changes promise great benefits to the community as a whole, and should be encouraged not resisted. Where I differ from the Committee is that I believe that the changes will be far-reaching and rapid, and that this should be recognised and anticipated.

Nor does rapid change in the demand for various skills imply the emergence of greater unemployment. To consider the impact of technological change on employment as a whole, we must consider the aggregate economy.

(iii) The macro impact

Few would deny that technological change can bring about substantial reductions in employment in individual firms, industries and occupations. Beyond this, there is widespread concern that technological change will lead to massive technological unemployment - 'jobless growth' in the economy as a whole. This is a perennial fear, which reappears whenever there is persistent unemployment. It occupied the minds of classical economists, including Smith, Ricardo, and Mill, at the beginning of the industrial revolution. It gained renewed prominence in the 1950's, as the development of computers raised the spectre of widespread automation. And today, the fear of widespread technological unemployment is at the forefront of public concern for the future.
Most economists, however, would deny the possibility of prolonged technological unemployment. The argument is straightforward general equilibrium analysis. The technological change will result in increased productivity. This increased productivity will be reflected in increased income for one or more groups - higher profits for the innovating firms, higher wages for the remaining workers, and through lower product prices, higher real incomes for consumers. The recipients will spend their increased income on this and other products, leading to a general increase in demand. New employment opportunities will be opened up, and displaced workers will find jobs in meeting the new demand. This process of change in the mechanism by which society achieves the optimal allocation of resources, in the face of continually changing tastes, resources and technologies. Resource allocation needs to be facilitated, rather than hindered.

This argument was outlined clearly by the Committee in Volume I of the Report. For example:

New technology, particularly labour-replacing technology, is adopted principally because it produces new things that people want or because it can satisfy existing needs at lower cost. The financial benefits so achieved can lead to the enterprise that introduces the change having higher profits (or lower losses) than it would otherwise have achieved. In some cases, the benefits may do little more than allow the enterprise to stay in business. In others, the higher profits may enable the firm to expand by investing in new productive facilities, or they may be distributed to shareholders as dividends, or to employees as wage increases, or to purchasers as price reductions. Usually the outcome is a combination of these things. Such distributions increase incomes, which, when spent or saved and reinvested create employment, often in areas of the economy quite unrelated to those that introduced the changes that started this cycle of events (Vol.1,p.166)

The process of adjustment need not be 'calm and easy' (I, p.168). Displaced workers, especially those whose skills have become obsolete, may remain unemployed for considerable time. Technological change can impose considerable costs on these displaced workers.
The difficulties people face in adjusting to change - whatever the source, whether it be technology, changes in tariffs or shifts in the community's desires for particular goods and services - should not be minimized...

The committee believes that the solution of the problem lies in the adoption of flexible and adaptable measures that assist people to adjust, and that share out the burden of adjustment without entirely removing people's incentives to plan ahead and to look after their own interests. It is convinced that resisting change or trying to perpetuate a particular structure of industry and of employment opportunities would be counter-productive. (1., p.72)

It should be pointed out, however, that this argument depends essentially on real growth in the economy - growth in demand for existing products, as well as demand for new products. Growth facilitates resource re-allocation, and eases the pain of structural adjustment. This observation is important for two reasons. Firstly, many of the opponents of technological change are really opposed to growth, or at least growth resulting from technological change. The economists case, assuming a priori desirability of growth, is unlikely to convince these critics that technological unemployment is impossible.

Secondly, the importance of an appropriate macroeconomic policy needs to be stressed. Costs of adjustment will be greatly aggravated if technological change is superimposed on an underemployed economy. A macroeconomic policy which promotes real income growth will facilitate the process of structural adjustment, and minimize the costs imposed on displaced workers. Aggregate economic conditions therefore strongly influence our ability to meet the challenges of technological change.

"...the key policy task for Australia is to ensure that the forthcoming technological changes are converted into real income growth rather than unemployment." (Sheehan [1980], p.105)
The Myers Committee recognized the importance of economic conditions, but felt that macroeconomic policy was not within their purview.

The speed with which new jobs appear depends mainly on how the extra income generated by technological change is distributed and spent, but it also depends on economic conditions generally and on government economic policies. High levels of unemployment have persisted in western economies despite stimulatory and other attempts to correct them, and the Committee is not in a position to comment on the efficacy of alternative macro-economic policy measures to reduce unemployment. (3, p. 74)

We are all well aware, no doubt, that the question of what is the appropriate macroeconomic policy has recently been the subject of intense debate among economists, especially in Australia. At this stage, there is no sign either of a consensus view emerging, or of a conspicuous record of success being deservedly attributed to one or other of the opposing sides. Until the economics profession is able to demonstrate greater accomplishment on the macroeconomic field it cannot expect widespread public confidence in its conviction that technological unemployment cannot prevail.

3. The Social Safety Net

The recommendations of the Myers Committee which have attracted the most attention are clearly those concerned with ameliorating the employment effects of technological change, the so-called Social Safety Net. The main elements of the Social Safety Net are:

- a period of notice prior to a change
- preparation for, and assistance with, finding another job
- retrenchment compensation
- income maintenance.

These provisions are contained in Recommendation 14, which reads:
7.101 The Committee recommends that the government support the introduction of a two-part retrenchment compensation scheme that would include:

7.102 Provision in awards for:

- a period of notice before retrenchment
- monetary compensation for lost seniority and other accumulated credits only
- assistance to find alternative employment

The award provisions would have to be established by a test case. The Committee recommends that the Government sponsor such a case based on standards in general accordance with the MIAC guidelines.

7.103 A temporary income-maintenance scheme that would:

- be funded by the government and administered as a supplement to unemployment benefits
- provide for persons retrenched through no fault of their own to receive for a fixed period after retrenchment a fixed proportion of their weekly earnings average over the 3 months prior to retrenchment, up to a maximum of the national average weekly earnings for the preceding quarter

The period of income maintenance might vary from 1 month for persons who were employed by the same employer for 3 to 5 years, up to 6 months for persons who were so employed for 10 years or more. The rate of benefit might vary with the period of employment from 60% of weekly earnings as defined above to 75%. A loading might be added for persons with dependents.

The first part, including monetary compensation and assistance with finding alternative employment, would be funded by employers, and be implemented through incorporation into awards. The Committee recommends that the government initiate a test case to achieve this. The second part, the income maintenance provisions, would be funded and administered by the government, as a supplement to unemployment benefits.

The Social Safety Net would not be limited to those demonstrably affected by technological change - it applies to all persons who lose their jobs through no fault of their own. Eligibility for the income maintenance provisions would be the same as for unemployment benefits. Consequently, some groups, and in particular married women, would be ineligible for income
(1) **The Objectives**

The provision of a Social Safety Net is justified (by the Committee) on the grounds of both equity and efficiency. A brief statement of these arguments is:

(a) **Equity:** The costs and benefits of technological change should be shared equitably in the community. Displaced workers incur a disproportionate share of the costs of technological change, whereas the benefits flow principally to the innovating firm and the consumer. Therefore, the community in general, and the innovating firm in particular, should help to ameliorate the losses of the displaced workers.

(b) **Efficiency:** Technological change offers benefits to the nation which more than outweigh the costs of its adoption. Workers, however, bear a disproportionate share of the costs of technological change, and they have the power to effectively impede its implementation. The net benefits of technological change are sufficient that it is worthwhile for the beneficiaries to compensate the losers, thus attenuating their opposition.

Though very different in their ideological justification, these two objectives are similar in their practical import. In particular, the measure of compensation is the same in both cases; namely the extent of the losses suffered by the affected workers. Let us first evaluate the social safety net in those terms.
(ii) Extent of the Coverage

The costs incurred by a displaced worker might include (Lydall [1980], p.277):

(a) The loss of accrued pension benefits, long service leave and other non-portable benefits
(b) the cost of changing residence
(c) the costs (including lost income) of unemployment
(d) the expense of retraining
(e) the loss of firm- or job-specific skills (human capital).

It would seem that only costs (a) and (c) are met by the Social Safety Net. Coverage for (a) is detailed in the following paragraph:

The financial compensation for retrenchment should be based on age and years of service and should be designed to compensate an employee who is forced to leave the firm through no fault of his or her own for such built up 'credits' as:

- accrued long-service leave and other benefits where such benefits cannot be transferred and for which no cash compensation is already given
- the employer's contribution to any superannuation or pension scheme to which the employee had entitlement
- seniority (the individual would usually be expected to start in a new enterprise at the bottom of any salary scale) and other intangibles (I, p.180)

The costs of unemployment, part (c), are met by the temporary income maintenance scheme, funded by the government.

Clearly, the costs of unemployment (to the individual) depend inter alia on his foregone income, which can be proxied by his earnings history. It is therefore only consistent with the expressed objectives (equity and efficiency) that the Myer's Committee would recommend that the unemployment benefits paid under the income maintenance scheme be earnings related. They
proposed that this be achieved through a supplement to existing unemployment benefits.

This is not the first time that earnings related unemployment benefits have been mooted for Australia, and it is common practice overseas. Opponents argue that (1) they may discourage efforts to find another job and (2) they are inequitable in that they create different classes of beneficiaries. The first objection was met in part by placing a time limit on eligibility for the benefits.

The second objection is more telling. Two classes of workers in particular would be discriminated against by earnings related supplements to unemployment benefits:
(a) those who have no recent earnings history, e.g. new entrants and re-entrants to the labour force;
(b) those currently ineligible for unemployment benefits, e.g. married women whose husbands are employed.

There is no evidence that the Committee even considered these problems. If they did, they would have had great difficulty in formulating an acceptable proposal. The first group comprises primarily new entrants into the workforce, i.e. teenagers, who are unskilled and have no experience. Current government policy quite clearly implies that they are less deserving of public assistance than other groups. The second group comprises mainly married women, who again are excluded from unemployment benefits currently by deliberate government policy. It is unlikely that the government would have accepted any proposal which undermined their policy with respect to these groups. Nevertheless, it should be recognised that the Social Safety Net has big holes, and that its implementation would aggravate the discrimination against certain groups in the workforce, particularly teenagers and married
women.

These are not the only holes in the net. No compensation is provided for losses (b), (d) and (e). The cost of changing residence (c) is perhaps not very significant. The same cannot be said of (d) and (e). In fact, the loss of human capital, and consequently the cost of retraining, is likely to be by far the largest component of the cost of displacement due to technological change. Moreover, fear of loss of human capital is likely to provoke the fiercest resistance to technological change. On both equity and efficiency grounds, compensation for loss of human capital and assistance with retraining should be paramount.

The omission of such compensation is curious. The costs of job displacement and policies were analysed in the commissioned study by Lydall [1980]. The main elements of the Social Safety Net were outlined by him, and were adopted faithfully by the Committee. Yet, his proposals for compensation for loss of human capital and the expense of retraining were omitted without comment.1

The Social Safety Net, therefore, is very uneven in its coverage. Most importantly, it excludes coverage for perhaps the most important of displacement costs: loss of human capital and expense of retraining. Secondly, certain groups, including married women and teenagers, are precluded from the major benefits. If full compensation for the costs of displacement is the objective, the Social Safety Net provisions are inadequate. Moreover, it has been argued that another substantial group, owners of capital, falls

1 It could be argued that compensation for human capital is intended under the heading "and other intangibles" in the quotation above. If that is the case, then the Committee took great pains to disguise their intent.
entirely through the net. This argument is taken up in the next section.

There is another element in the Social Safety Net package which deserves comment, that is the provision in industrial awards for early notification and consultation. This appears to be only common sense. Yet, the ABC survey commissioned by the Committee revealed that only 3.8% of small and 35.8% of large enterprises consulted with affected employees prior to the introduction of technological change. Of course, it will be argued that prior notification will aggravate resistance, and be detrimental to the innovating firm. However, there is some evidence to the contrary. The Report (I, p.129) refers to a comparative study of the introduction of new technology in Great Britain and Germany. In Britain, where notification and consultation were rare, change was met with much greater resistance. Given the scale and pace of anticipated technological changes, a transformation of the apparent standard practice in Australia seems desirable and overdue.

(iii) Compensation for capital?

Cassing and Hillman [1980] have argued that the Social Safety Net is fundamentally flawed, in that it does not compensate those who are really harmed by change, that is immobile factors. Labour which moves to alternative employment does not bear the brunt of adjustment costs. Rather, these are borne by factors which cannot adjust, namely specific capital and labour. Their argument that mobile factors incur no adjustment costs depends upon flexible factor prices. Rigid wages are more characteristic of the Australian economy, and in this case, displaced workers do incur real costs. Nevertheless, it is true that owners of capital can suffer big losses as a result of technological change, and they receive no compensation from the Social Safety Net. The Social Safety Net treats capital and labour asymmetrically.
This asymmetry can be justified in two ways, depending on whether the equity or the efficiency objective is paramount. Let us first consider the equity objective - namely, the goal is to share the costs and benefits of technological change. Compensation for losses has two ancillary effects: it imposes real costs on the economy and it alters the distribution of income. Ceteris paribus, it might reasonably be argued that compensation for losses is desirable if (a) the benefits outweigh the costs, and (b) it promotes a more equal distribution of income, and vice versa.

The costs to society of compensating capital might be very large. If the government stands ready to make good any losses incurred by capital, incentives for efficient investment are greatly reduced, and the problem of 'moral hazard' would be severe. The stock market is essentially an institution through which capitalists can insure against failure by diversification; the same opportunities for diversification are not available to labour.\(^1\) Moreover, since holdings of capital are distributed very unevenly, compensation of capital would promote a less equal distribution of income.

There are of course costs to society of compensating labour for losses due to technological change. It is a defensible judgement - though only a judgement - that the benefits of compensating labour outweigh the costs of compensation, and that compensation would promote a more equal distribution of income. Conversely, in practice, the costs of compensating capital might be so large as to outweigh the benefits. Therefore, somewhat tenuously, asymmetry

\(^1\) As Cassing and Hillman [1980] rightly point out, not all holders of capital can diversify, e.g. owners of small businesses. Nevertheless it is true that opportunities for diversification are much greater for capital.
in the treatment of capital and labour can be justified.

The Social Safety Net is on firmer ground if efficiency is the paramount objective; that is, if the Social Safety Net is designed to dissipate resistance to change, and make technological progress politically more acceptable. Capital losses are more concentrated, and balanced by gains to other holders of capital. Through diversification, large enterprises are less likely to be severely affected by technological change. Small enterprises are effectively restricted for redress to the political process. Labour losses are more diffuse, and the losers have available to them industrial as well as political action. The effectiveness of industrial action is enhanced by a strong tradition of solidarity. Moreover, capitalists are adversely affected by technological change only indirectly, when it occurs in a competing enterprise over which they have no immediate control. Workers, conversely, are generally directly affected by the introduction of technological change into the enterprise by which they are employed. On the whole, then, workers are likely to be much more effective than small capitalists in resisting technological change. Therefore, the asymmetric treatment of capital and labour could be justified on efficiency grounds.1

Unquestionably, the Social Safety Net does involve the asymmetric treatment of capital and labour. However, I hope that I have demonstrated that this is not necessarily inconsistent with either of the objectives.

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1 It is ironic that at about the same time as the Cabinet was reported to have rejected a large part of the Social Safety Net (Financial Review 17 September 1980), it accorded special legislative protection to service station owners. This is not necessarily a counter-example to my hypothesis. First, the case allegedly involved abuse of market power, as well as technological change. Second, the service station owners threatened to resort to industrial action.
offered for the Social Safety Net, though perhaps more compatible with the
efficiency objective.

(iv) Financing the Social Safety Net

The cost of the Social Safety Net is to be shared by innovating firms and
the taxpayer. Employers would be liable for the full costs of monetary
compensation, and for assistance in finding alternative employment. The
income maintenance scheme, entailing supplementary unemployment benefits would
be funded by the government. Sharing of the cost between employers and the
government was recommended by Lydall (1980), on the grounds of reducing moral
hazard. But, there are better grounds for sharing the costs of the Social
Safety Net.

Irrespective of whether the equity or the efficiency objective is
paramount, the cost of the Social Safety Net should fall on the beneficiaries
of technological change. Beneficiaries of the process of technological change include:

1. Innovating firms
2. Consumers
3. (Possibly) other employers, i.e. non-displaced
   workers and workers with skills demanded by the new
technology.

Economic theory suggests that the gains to firms and workers are
transitory, and that the principal beneficiaries of technological change are
consumers. There is some evidence to support this view (Kaspura and Ho-Trieu
(1980)). Therefore, consumers should bear the largest share of the costs of
the Social Safety Net.
The share of workers in the benefits of technological change in any instance will be very difficult to assess, since it depends strongly on interactions in other markets. We can be more certain that innovating firms do receive a transitory benefit, since other wise they would not introduce the change. They may be able to retain the benefit for some time, if they enjoy some market power.

Therefore, under either the equity or the efficiency objective, the costs of the Socia Safety Net should be shared by consumers and by the innovating firms, with consumers bearing most of the cost. Ideally, the adjustment costs would be borne by the consumers of goods which benefitted from the technological change. That is, if it could be shown that a technological change promises to lower the price of good A, the adjustment costs would be financed by a temporary sales tax on that item. Administrative and information costs preclude this solution. Financing the bulk of the Social Safety Net out of general revenue is a compromise solution. The financial mix advocated by the Committee is appropriate.

(v) Evaluation

In terms of the objectives set by the Committee, the Social Safety Net proposal clearly has a very serious shortcoming. Its coverage does not extend to the two major adjustment costs imposed on displaced workers - the devaluation of human capital and the expense of retraining. To return to a major theme of this review, I believe the explanation for this omission lies in the Committee's myopic and ill-considered view of future technological change. There is good reason to believe that we are now on the threshold of a new era of technological change. The next twenty years hold the promise of technological change on a scale unknown in the past. Occupations and opportunities will change much faster than they have in the past. There is of
course no certainty of this outcome. But, it is likely. I have given some reasons for this judgement in the previous section. If this view of the future is accepted, the Social Safety Net has very large holes.

But, is a Social Safety Net desirable? This depends upon the objective. If efficiency is the primary objective, then the question of whether the Social Safety Net will promote or retard change is paramount. This is by no means obvious. On the one hand, to the extent that it dissipates labour opposition, and that opposition would otherwise have been effective in opposing change, it will facilitate change. On the other hand, it will exert some retarding effect on change. First, since part of the cost is borne by innovating firms, the Social Safety Net adds to the cost of making changes, and thus reduces the incentive to introduce profitable technological change. Second, provision of higher unemployment benefits will to some extent reduce the incentive to seek additional employment, thus slowing the transfer of resources. Third, the additional taxes needed to finance the scheme will probably decrease the flexibility and adaptability of the economy. Thus, the Social Safety Net has both promoting and retarding effects on the rate of implementation of technological change. If efficiency is the goal, the net effect is of paramount importance. The Committee clearly believed that the net effect would be positive. But, as far as I know, there is no hard evidence to support this view. The Social Safety Net will bring about a more humane, and perhaps for many, a 'better' economy, but whether it promotes or retards technological change is, I think, an open question.

The Social Safety Net will contribute to sharing the costs and benefits of technological change. Whether it will achieve this objective adequately, and whether this is a desirable objective itself, is a matter of judgement. In making this judgement, it must be remembered that the Social Safety Net has
many holes - small business owners, married women, teenagers, and so on. Essentially, the Social Safety Net amounts to a compulsory scheme for the pooling of certain risks - in particular, the risk of personal obsolescence. Individuals premiums for this insurance are not tailored to individual risk, and some participants hold very inferior policies. The scheme carries a large 'administrative' cost. Is a pooling of risks in the lottery of economic life desirable? If so, is this the best policy we can design?

For many years, economists have been advocating an alternative insurance scheme. In its purest form, this involves replacing all existing welfare schemes by a negative income tax system - which would guarantee to every individual or household a minimum (livable) income. The current welfare system in Australia is a complex labyrinth of different programmes, which interact in manifold and unforeseen ways. It requires a substantial administrative overhead, and leaves many beneficiaries facing very high marginal tax rates. Every addition to the overall scheme adds its own measure of complexity, and creates new problems. The day must come when the foundation is inadequate to support the ever-growing edifice, and when almost all marginal renovations are strongly and effectively resisted by special interests. Only a complete re-examination and re-design can overcome the opposition of the few for the good of the many. Perhaps, the widespread recognition of the need to make special provision for future technological change is the opportunity to re-think the fundamentals of the Australian welfare system. This task was clearly beyond the scope of the Myers Committee. But, it is not too late to look at it again.
4. Social Effects of Technological Change

The impact of technological change is not limited to employment, but has far wider economic, social and political ramifications. These potential changes have aroused almost as much public concern as the fear of loss of jobs, and many of the strongest opponents of technological change draw their inspiration from the ostensibly deleterious social and political consequences. These "Social Aspects of Technological Change" are discussed in Chapter 6 of the Myers Report.

Most of the Committee's discussion deals with effects in the workplace. Prospective technological change, especially microelectronics, will encourage existing trends towards improved physical working environments and increased flexibility of work organisation.

In such areas as lighting, air treatment and seating, new technology has enabled the improvements and benefits to be widespread and at low cost. It is the Committee's view that the likely new technologies have the potential to make significant further improvements in the working environment and that this is one of the important ways in which workers may expect to benefit from technological change. (1, p.144)

and

Some of the likely new technologies are opening up the possibility of achieving at reasonable cost much more flexible working arrangements, and the opportunities so provided could benefit especially those who at present are in the disadvantaged groups. (1, p.145)

New arrangements include autonomous work groups, part-time work, flexible hours and work-sharing.

A less obvious implication of the new technology for work organization pertains to abnormal working hours, especially night time work. Concern was expressed to the Committee that the need to maximise the use of expensive technology, in particular computers, will result in more frequent resort to
shiftwork (I, p.154). On the contrary, however, new technology could be used to eliminate the need for night work. The Committee believed that higher labour costs for abnormal hours provided an incentive for this development in Australia.

The impact of technological change on skills is a popular and long-standing concern. It is easy to find examples where skills have become obsolete, and this is likely to become prevalent in the near future. It is also easy to point to new skills which originated as a result of technological progress. The popular belief is that the former outnumber the latter. On the contrary, the Committee concludes, correctly in my view, that, on average, particularly in the longer term, the likely new technologies will increase the number and range of skilled intellectual tasks and decrease the number of unskilled tasks. In part this is likely to be because unskilled tasks are usually easier to automate and in part because, as the educational standards and aspirations of Australians rise, it will be harder to get people to do the less attractive unskilled tasks. (I, 61)

However, a rapid transformation of skills will not occur easily and painlessly — which underlines the importance of educational and retraining opportunities.

Another prevalent fear expressed to the Committee concerns the impact of technological change on health and on the environment. The report provides us with little insight into this problem.

The contemporary question of technological change and its effect on the environment is a natural extension of the debate about ecology, damage to the environment, and pollution. The Committee recognises the validity of environmental concerns and commends the work of the various bodies set up to monitor the situation and to deal with present or anticipated threats to the balance of nature. (I, 153-4).

The report goes on to point out that "new technology can be used to produce anti-pollution devices and can enable the development of low-pollution
processes" (I, p.154). It is certainly true that microelectronics offer great hope for combating pollution, as was discussed in Section 2. But, fears for the environment are aroused primarily by other predicted technological developments, such as genetic engineering, new toxic substances, and so on. There is very little reassurance on this point in the Report.

On the whole, the discussion of the social impact of technological change is fragmentary and superficial. It completely omits any consideration of some of the more far-reaching social ramifications likely to flow from future technological change.

Of major significance will be the substantial increases in leisure time likely to flow from the increased productivity of automation. This could take the form of a more rapid reduction in "normal" working hours, an increasing dispersion in working hours between individuals, or a reduction in working life. In my view, some combination of the second and third is most likely. The average individual will have a much larger amount of leisure time to enjoy or to "fill in". The consequences could be enormous. On the one hand, it could lead to greatly increased demand for "leisure" services, for education and "self-improvement" courses, and stimulate participation in community affairs, and, in general, enhance our ability to use leisure time constructively and satisfyingly. On the other hand, it could result in increased alienation, frustration, boredom, vandalism and other crime. The challenge is to realise the first alternative without the second.

Among other things, this implies that the current fashionable concern with "vocational education" is probably misplaced. Instead, preparation for ample leisure time should be one of the priorities of education at all levels. The disregard of the implications of increased leisure time, especially for education, is one of the most serious defects of the Myers report.
In a related vein, possible changes in work organization are much more extensive than the Committee envisaged. In fact, technological developments could undermine the very foundations of centralized work centers, i.e. factories and offices. Initially, manufacturing was carried out in the main in association with the home. The reasons that work was centralized in factories, and subsequently in offices, were twofold—economies of scale and the need for better coordination and communication. Microelectronics could render both these reasons obsolete. Intelligent machines diminish economies of scale. Small production runs and custom products become economically feasible. Computers, large and small, can be used to improve coordination, and distance is no longer a bar to efficient communication. At the same time, the costs of transportation to a centralized workplace have increased dramatically in recent years, while our cities are designed for an earlier age of cheap transport. The result is bound to be a re-emergence of cottage industries and work-in-the-home. This has obvious and far-reaching implications for transport systems, fuel supplies and the planning of cities. For example, consider the impact on energy usage if commuting was reduced by one-third. Given the very long lead times involved, especially in urban planning, these likely developments need to be reflected in current planning.

Another possible development worthy of consideration concerns political institutions. One justification for representative government is the infeasibility of polling the total voting population on any issue. Microelectronics will demolish that justification. Already, there is a community in Ohio which has a two-way television system, in which viewers can answer questions by pushing buttons on a small console. The results are

1 Of course, a job serves more functions than just earning a living. It is an important avenue of social intercourse. This need, however, could be satisfied by extra-work activities in the local community.
recorded and tabulated instantly. The system has been used for conducting surveys of viewers on a wide variety of matters. It does not take much imagination to see such a system implemented nationally, with televised "citizen meetings" and instant referenda - a development I view with some trepidation. At the very least, the ability to quickly and effortlessly poll voters could have a profound impact on the behaviour of political institutions, and the manner in which collective decisions are made.

5. Other Recommendations

A cynical view of the role of Committees of Inquiry is that they are designed to produce a large number of easily passed recommendations. Then the government can accept these and reject the more far-reaching recommendations, while maintaining that it has accepted the bulk of the Report. On this criterion, the Myers Committee performed par excellence.\(^1\)

Of the thirty recommendations in the Report, eight recommend the establishment of new bodies, or the enlargement or restructuring of existing bodies, and a further twelve recommend further research and further study. Only ten recommendations advocate substantive action, three of these being recommendations to preserve the status quo.

It is not possible to consider each of the recommendations in detail, but some brief remarks on recommendations not considered elsewhere follow:\(^2\)

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1. The government also has fulfilled its role. On 3/8/80, the Prime Minister predicted substantial acceptance by the Government of the Myers Report (The Australian 4/8/80). Although final decisions have not been made public, the Financial Review reported on 17/9/80 that "the Cabinet had rejected major recommendations of the Myers Report on technological change, including the call for a social safety net."

2. Recommendation numbers are given in parentheses.
(i) **Union Amalgamation** (2,3,4,5,6)

The subject of union amalgamation is a perennial Australian policy issues. In essence, the Committee recommends that the process of amalgamation be facilitated, by amendments to the Commonwealth Conciliation and Arbitration Act, and the Public Service Arbitration Act. Less reasonably, they advocate that public funds be made available to unions to meet legal and administrative costs associated with amalgamation.

(ii) **Wage Relativities** (7,8)

The Committee believes that wage relativities in Australia are distorted, and margins for skill inadequate. They recommend more discussion and consultation, especially towards fostering the introduction of broadbanding into awards.

(iii) **Working Environment** (9,10,11,12,13)

The Committee recommends the establishment of two new government bodies, and a change of name for a third. They also call for more research.

(iv) **Education and Training** (15,16)

The benefits of anticipated technological change will be maximised and the adjustment costs minimized, by a society which is adaptable and flexible, readily able to learn new skills and capable of using greatly increased leisure time proficiently. In this regard, education, training and re-training are of paramount importance. Moreover, education is one area where government action is likely to be appropriate and effective. The Committee's recommendations on education and training are neither momentous nor ambitious. They recommend further monitoring of literacy, numeracy and subject choice, and further study of technological change.
(v) Research and Development Assistance (17,18,19,20,21,23,24)

In Australia, there is a bewildering array of government programmes and policies which directly or indirectly promote research and the development and introduction of new technology. Volume 3, which is devoted to a review of such government policies, identifies approximately 374 such policies and programmes. These include:

- direct research and development grants and subsidies
- support of research institutions, such as CSIRO and tertiary education institutes
- research activities of government departments, such as Departments of Defence, Health, Transport
- taxation incentives, such as accelerated depreciation and investment allowance.

The issue of research and development grants is critically analysed by Gennicott [1980] in a commissioned study. He argues that too much emphasis in Australia has been placed on basic research, and that more attention should be devoted to commercial development of imported technology. Furthermore, there is evidence that Australian research grants are concentrated in oligopolistic industries, which are likely to invest in forms of R&D which can be completely appropriated by the firm. In this case, government support cannot be justified on the basis of externalities. If uncertainty is the justification, then contingent loans are a preferable instrument to outright subsidies.

A commissioned study by Parry [1980] revealed that

...industrial R&D grant funding led to earlier implementation of R&D projects and to the undertaking of projects which would not otherwise have been carried out. What was not clear from the survey was whether there were any significant benefits from either earlier implementation or the carrying out of R&D that would not otherwise have occurred. (IV, p.326)
Apparently, R&D grants were very successful in promoting the employment of scientific and technical personnel. Whether the general community received any return from the public expenditure is unclear.

In the light of this evidence, the Committee essentially advocated maintenance of the status quo. They recommended retention of commencement grants, the provision of project grants by means of loans as well as subsidies, and more stringent conditions for the public interest projects. In addition, they recommended an early review of depreciation rates, retention of investment allowances, and inter-government discussions on replacing the payroll tax.

(vi) Venture capital corporation (22)

The United States has a thriving system of venture capitalists which provide equity capital for innovative but high risk undertakings. The Myers Committee believes that the existing Australian financial system is not adequate to this task, because of regulatory constraints and a general emphasis on security.

The Committee's solution is to recommend the establishment of a government-funded venture-capital corporation "to provide risk-capital to individuals and to small and medium-sized enterprises to facilitate the bringing to production and the marketing of promising inventions and innovations".

The danger is that such a corporation will in the main fund proposals which the market was right to leave alone. The preferable alternative, surely, would be to remove the regulatory constraints and to enhance the flexibility and variety of the existing financial system. This may have been outside the terms of reference of the inquiry, but it should not be beyond the
bounds of the policy debate.

(vii) **Technology awareness programme** (25, 26, 27)

"The Committee believes that there is a general lack of information throughout the community on the nature and likely consequences of new or potential technological developments." For this reason the Committee recommends

- the establishment of a Technology Awareness Programme, to produce and disseminate educational material
- public financial assistance towards setting up a research and educational unit within the ACTU
- provision of consultancy grants to small businesses

This latter recommendation is amazingly ill-considered. It provides for once only grants limited to $2000 on a dollar-for-dollar basis "to employ consultants to advise [small businesses] on the application of microelectronics and computer-assisted manufacture" (p.197). This would bring a tremendous boom to the computer industry, but the benefits to the community are hard to perceive. The principal justification seems to be that the United Kingdom has such a programme, and therefore Australia should have one too. If fully implemented, its cost could far outweigh the cost of all the other recommendations combined.1

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1 As a very rough approximation, assume there are 500,000 small businesses in Australia. The potential cost is then $1 billion. By contrast, the Committee estimates that the potential cost of the social safety net as $15-$20 million.
(viii) **Technology assessment** (28,29)

The Committee recommends the establishment of two new committees to monitor and evaluate technological change at a national level - a Standing Committee of the Australian Science and Technology Council and a Council of Commonwealth and State Ministers.

(ix) **Privacy** (30)

One of the most vexed questions arising from a consideration of technological change concerns privacy. The potential for abuse is immense, and effective safeguards rare. The extent of the problem is probably underestimated by those who are not intimately familiar with the new technology. The Committee recognised that privacy was a pressing problem:

The Committee is concerned that, although a considerable time has elapsed since the problems of the potential intrusion into personal privacy made possibly by new technology have been recognised, the rights of individuals with respect to the collection and use of personal data are not well established. (I, p.157).

The Committee's recommendation on privacy is hardly likely to stimulate rapid and effective action. In full, it reads

**Recommendation 30**

The Committee recommends as follows:

1. A review should be made of legislative action proposed to safeguard personal privacy in relation to information stored on data banks. Efforts should be made to enact appropriate legislation in the near future.

2. The parties directly involved in electronic systems that monitor individual employees should consult on appropriate standards to be observed. If necessary, this should be the subject of government action.

Their treatment of personal privacy is typical of the overwhelming superficiality of the Report. The issue warranted a well-informed and intelligent analysis of the likely problems, and the effectiveness and
desirability of various solutions, with specific recommendations for action. Instead, we are provided with two pages of perfunctory remarks, culminating in a nebulous recommendation which sets no goals, provides no criteria for achievement and assigns no responsibility for action. At best, it will give the naive a "nice warm feeling".

6. Conclusion

Probably the most frequent reaction to the Myers Report in the days following its publication was to label it 'superficial'. It is an easily made comment, which can be used as a substitute for more specific and incisive criticism. However, careful study of the Myers Committee Report has convinced me that the charge is justified. As an investigation of "the process of technological change in Australia", it is overwhelmingly superficial and short-sighted.

It seems evident that the Committee misunderstood even the current state of technology, and they grossly underestimated the future potential. In part, this is because they made the common, but erroneous, assumption that future technological change will be just like past technological change, although maybe a little more rapid. They took an uncritical look at the past, and unquestioningly extrapolated this to the future. But the challenge posed by the new technology is that past is not a good guide to the future. The real significance of microelectronics is not that it makes new things possible, but that it makes new things economically feasible. For the first time, capital cost is no object to the introduction of intelligent machines.

To be sure, potential will outstrip implementation. Application of the enormous potential of new technology will take significant time, because institutions and individuals are slow to adapt and change. But, we must be
careful to avoid another common misconception, to which the Myers Committee fell prey. The mistake is to underestimate the extent to which relative price changes will accelerate the adoption of new technology. As an example, the Committee felt that the spread of word-processors would be slowed by a continuing significant cost differential in favour of typewriters. This overlooks the near certainty that this cost differential will be rapidly eliminated as the now mechanical parts of word-processors are replaced with microelectronics. As another example, the changing relative cost of communication versus transportation will have a profound effect on the organization and location of work. Large changes in relative prices will provide a powerful incentive for the adoption of technological change, whether or not it seems desirable or necessary from our current perspective.

Another very common flaw in discussions of technological change is to consider various potential developments as largely independent. In fact, the greatest impact will flow from their interaction, and their synergy will generate a far greater impetus to change than their independent benefits. Here again, the Myers Committee fails. For example, they treat wordprocessing as one development, computerized data storage as a second, communications as a third, and computer aided manufacture as an entirely separate issue again. Yet, it is clear that enormous benefits can and will be extracted from integrating these developments. For example, integrating wordprocessing and communications networks leads to electronic mail; together with computerization, we have the elements for an electronic funds transfer system. Yet, neither electronic mail nor electronic funds transfer are discussed in Volume I of the Report. The impact of these integrated systems on employment, and on society, will be far, far greater than the impact of the technological developments independently.
On the whole, the recommendations of the Committee are an innocuous potpourri of good wishes and pious thoughts. Many call for new committees, larger committees, or new names for old committees. Many more call for further study by these new committees, or by existing committees. There are some exceptions, which were discussed in the previous section.

The centrepiece of the Committee's offering is undoubtedly the social safety net. Justly, it has received the most attention in discussion of the Report, and indeed in this review. Basically, it should be seen as a compulsory national insurance scheme, financed by consumers as taxpayers, in which certain groups hold very inferior policies, and for which the administrative overhead could be quite high. The social safety net cannot reasonably be considered in isolation from the overall social welfare system. In this context, it is worth considering whether an alternative insurance scheme, such as a negative income tax, would be superior.

Paradoxically, the recommendations are weakest in the two areas where the need is greatest - education and re-training, and the protection of privacy. Moreover, these are problems where government action is appropriate, and likely to be effective. But, they are difficult and controversial areas, and the Committee here avoided any hard decisions. In part, this must be due to their misapprehension of the present and future technology, and its expected impact. In fact, in considering the recommendations as a whole, it must be remembered that they are premised on a technological future very like the recent past.

Throughout this review, I have assumed that the role of the Committee of Inquiry into Technological Change in Australia was to carry out their terms of reference "To examine, report and make recommendations on the process of technological change in Australian industry in order to maximise economic,
social and other benefits and minimise any possible adverse consequences*. They were given an extremely difficult task, and if one attempts to evaluate their achievements in terms of this goal, the judgement must be rather harsh.

But, that is a naïve view of the role of a Committee of Inquiry. An alternative view is that Committee’s of Inquiry are designed to defuse tough political situations. In this case, the establishment of a Committee of Inquiry followed an industrial dispute involving Telecom, and occurred against a background of continuing industrial tension and community apprehension over the introduction of technological change. From this perspective, the Committee would be successful to the extent that it was able to dissipate industrial and community resistance to change, and provide the government with the opportunity to appear as actively promoting solutions. On the second criterion, the Committee scores high marks. As to the success of their recommendations in diffusing resistance to change, we will probably never know, as it appears that the current government will not implement their major recommendations.
APPENDIX

The terms of reference of the Committee of Inquiry into technological change in Australia were:

To examine, report and make recommendations on the process of technological change in Australian industry in order to maximise economic, social and other benefits and minimise any possible adverse consequences. In particular the Committee would:
(a) identify:
   (i) technological change which is occurring or is likely to occur in Australia;
   (ii) new technologies which have the potential for substantial impact in Australia;
(b) examine relevant overseas experience and studies of technological change, and assess mechanisms used to introduce and evaluate new technologies;
(c) review the effectiveness of government policies and programs in facilitating the introduction of new technology.
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Note: CITCA is an acronym for the Committee of Inquiry into Technological Change in Australia.
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