THE INTERACTION BETWEEN TECHNOLOGICAL DEVELOPMENT, SOCIETAL CHANGE AND EDUCATION - AUSTRALIA, A CASE STUDY

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The substantial emphasis in this paper is on changes at three levels of education in response to, and interrelated with, Australia's pattern of industrial expansion, societal pressures and technological development over forty years since World War II.

This paper reviews and attempts to interpret the interlocking factors in this pattern of expansion. The composition of the population of Australia changed through successive waves, first of European and later of Asian immigrants. This gave the nation an injection of technological skills basic to a developing economy. During the 1960s and 1970s significant mineral discoveries provided a new dimension to traditional primary production centred on wheat and wool. The strength of investment from overseas and the recent sophistication of commercial enterprises mirror an exciting economy.

Embedded in this pattern of technological and societal transformation is a range of educational systems, State-based, which are broadly responsive to the nation's changing needs and are developing flexibility in meeting these. This paper reviews three distinctive levels across the educational spectrum and traces the extent to which each is supportive of and interacts with the nation's industrial and commercial sectors.

When the industrialization of Australia began more than a century ago it was within the context of an agricultural economy. The important gold mining discoveries of the 1850s led to a dramatic rise in the immigrant population, substantially from the British Isles. This gave a stimulus to manufacture and to mining for other metals. It was accompanied by steady growth in agriculture to sustain the new colonies. The 1880s were a period of boom built around public work, land speculation and further mineral discoveries. Into the new century a further impetus was given through the establishment of steel works and related manufacturing. From this point to the years of prosperity,
1920–1929, manufacturing production expanded by 40 per cent. As Australia moved out of the Great Depression manufacturing industries responded to government stimulation and tariff protection, thereby providing a launching pad for further industrial expansion. Factory employment increased by 30 per cent in this period. Wartime experience in engineering showed the great potential for Australian industrialisation. It became the basis for subsequent production of capital equipment as well as consumer durable goods.

During World War II Australia became for the Allies not only a food arsenal but also a significant contributor to the technology of war. Australians learned that technologies and technical change are not autonomous, nor are they in a vacuum. Rather, they are produced within a social, economic and cultural context.

This was most evident in the highly successful Commonwealth Reconstruction Training Scheme (CRITS). Through this scheme thousands of ex-service men and women received government funded preparation for re-entry to the work force. The peacetime perceptions and career aspirations of many were strengthened through courses in technical colleges, institutes of technology and universities. Although technical colleges received a tremendous financial fillip from CRITS, the main effect was on the rigidity of trade courses within them. The more mature trainees, as new entrants to industry, found stereotyped courses in trade theory and trade practice insufficient to satisfy their needs. Those, however, who were able to embark upon higher level technology courses, either for a degree from a university or a diploma from an institute of technology, reacted more favourably to the intellectual challenge and social atmosphere. The overall impact of CRITS on the preparation of adult tradesmen, technicians and technologists was tremendous.

Between 1945 and 1960 the manufacturing labour force increased by more than 60 per cent. Immigrant labour played a proportionately larger part in manufacture than in the labour force as a whole. This was the industrial growth of an affluent economy, which had a persistent inflation rate of 2 to 2 1/2 per cent per year. It was embedded in a society committed to full employment, to extensive welfare and health schemes, to ensuring high standards of living and to a vast expansion in educational opportunity. This led to significant individual and small business investment, to the strengthening of existing, and to the formation of new, industrial enterprises, and to a changed employment structure. Industries in six categories showed enhanced employment prospects. These were electrical, plant and equipment,
motor repairs, iron and steel, paper products and motor bodies. Decline was most marked in the clothing and textile industries. High employment levels offered a measure of consumer and investor confidence, untramelled by the impact of rapid technological change still twenty years away. It was a type of euphoric state apparently never to end.

During this period of affluence the first significant intervention for education by the Commonwealth Government occurred. It assumed a national responsibility for leadership preparation in industry, commerce and the professions. The Murray Committee was commissioned by the Liberal Government to enquire into university education in Australia. In 1954 the Committee recommended substantial funding so as to enhance the quality of university education, especially at the postgraduate level. In so doing it justified a very significant contribution to the national economy. During the next ten years, thanks to this stimulus, the number of bachelor degrees awarded rose by 57 per cent and the number of higher degrees by 125 per cent. Much of this higher degree emphasis was in faculties of science and technology. In a period of relatively full employment this represented a significant input to Australian industry.

Departments and Branches of Technical Education across the States responded to pressure from industry for better trained apprentices and operatives. The movement towards day release offered trainees a sounder basis for coping with technical college courses, which emphasised the principles underlying industrial practice. Course outlines became definitive and clearer, and the links between college training and the real situation at the workplace were better articulated. In Sydney and Melbourne separate teacher training centres emerged. These and related efforts in other cities did much to strengthen the competence and confidence of technical teachers.

Meanwhile in secondary schools manual training focussed on the development of proficiency in manipulative skills as an educational goal, not necessarily as a basis for entry to industry. In consequence, students coming to technical colleges from secondary schools had been offered a manual training component that was still too stereotyped, being confined to basic skills with wood and metal supported by technical drawing.

The 1960s was one of those rare cornucopia periods when it was apparent that the Australian economy was locked into a continual process of growth. The rate of growth in wealth was so high that even relatively mild redistributive processes ensured that nearly
all sectors of the community benefited. Growth was the order of the
day and bigness became the test of effectiveness both in the
private and the public sectors. The pendulum shifted towards
manufacturing. Of about 4.9 million people in the Australian
labour force at the 1966 Census - including employers and self
employed - about 1.3 million or 27 per cent were classified as in
manufacture; primary production and mining accounted for less
than 11 per cent. The Vernon Report (1965) concluded: "The
proportion of the work engaged in manufacturing is higher in
Australia than in many major industrialised countries, including
Canada, France and Japan, but it is lower than in the United
States, West Germany, the United Kingdom, Sweden and the
Netherlands". Australia had emerged as a middle order industrial
nation.

There was in this growth period strong demand for talent.
Promotion became the outward and visible sign of inherent worth.
There was generated an economic and social climate that was
exciting yet illusory. It was set in a period of relative
international stability and shrouded in a philosophy that promotion
and advancement were natural and inevitable rewards.

Within this affluent economic climate, with the presumed con-
tinuation of an annual rate of growth of 4 per cent in GDF, the
Martin Report of 1964 offered a significant stimulus to the tech-
nological sector of tertiary education. The Liberal Commonwealth
Government accepted the major thrust of the Report that there be
a considerable financial boost to the so-called Institute of
Colleges. These institutes of technology were providing industry
and commerce with an alternative to the university graduate.
These diplomats were much sought after by employers in that
they had a much more practical orientation, often through sand-
wich courses. The Martin Committee framed its recommendations in
the belief that "education should be regarded as an investment
which yields direct and significant economic benefits through
increasing the skill of the population and through accelerating
technological progress". The successful institutes of technology in
the cities and larger provincial towns of Australia are testimony
on the investment by the Commonwealth Government in this sector
of education.

During the 1960s technical colleges differentiated course offerings
extensively so as to meet emergent specialisations within industry
and commerce. This was especially so with post-trade and
certificate courses and with new courses designed to meet
differentials within industry. Technical college authorities used
advisory committees so as to have the fullest input of employer,
employee and community perceptions. In this way they not only assessed the needs of industry and commerce but also educated managers and employers to refine their needs. This latter was most apparent in the provision of middle level courses for technicians and managers.

Reforms in secondary education were characteristic of the 1960s. The Wyndham Report of 1957 was progressively implemented from 1961 onwards. Its effect was to offer a wider range of electives beyond a core of English, Mathematics, Science and a social science. It led to the demolition of a rigid structure of secondary education and its replacement by comprehensive area schools. Similar movements occurred in other States, primary and secondary education being their statutory responsibility.

In the process of orientation to the wider community, secondary schools became more aware of relationships with industry and commerce. The subject variously known as Manual Arts or Industrial Arts or Technical Studies revealed a shift of emphasis towards plastics and other new materials used in industry. There was a freer approach towards individual choice in design and construction. The subject began to be taken by girls as well as boys and tended to enjoy greater parity of esteem.

The grand, confident expression of the fabulous 1960s collapsed with surprising speed in the early 1970s. The sweeping oil price increases of 1973 coupled with American policies for financing the war in Vietnam heralded a gross rise in inflation world wide. The 1970s became years of stagnation for Australia with a marked under utilisation of productive capacity and relatively weak levels of investment, particularly in manufacturing. This was compounded by the growing militancy of the trade union movement with consequent rapidly rising wage levels.

Within this declining economic climate the impact of technology has been more closely scrutinised. Technological change necessarily implies risk and uncertainty. During the 1970s two very important economic developments were evident in Australia. One was the manifestation of a wider international phenomenon, the decline of the rate of growth of the world economy. This led to a general rise in the level of unemployment among most of the industrialized economies of the world. Australia showed the most pronounced increase in unemployment of these economies. The second development was a change in the general emphasis of government policy on protection of manufacturing industry in Australia. This came about through a tariff cut of 25% across the board by the Labor Commonwealth Government in 1973. Suddenly manufacturers
were placed in a less competitive position internationally through
this partial withdrawal of protection. Of significance to education
was the imperative that Australian industry, and the
manufacturing sector in particular, should become more
competitive and more export oriented.

With this dramatic economic downturn and the challenge for
industry to become more competitive, it was natural for the
Commonwealth Government to set up an enquiry into the nature of
courses within technical and further education, their relevance to
the needs of industry and commerce, and the financial boost
necessary to maximise the output of quality students. The
resultant Kangan Report of 1974 is regarded as the watershed for
technical and further education. The Report strengthened the
identity of TAFE, the generic term to cover the several State
provided systems of technical and further education. In espousing
a philosophy of recurrent education and access, the Kangan
Committee provided the basis for breaking down the barriers
between course levels in the systems and for offering scope for
access to courses with advanced standing. So as to achieve its
objectives the Kangan Committee recommended an infusion of 100
million dollars to TAFE throughout Australia for recurrent
capital needs over an eighteen month period. In 1975 the
Commonwealth Government, in accepting the major
recommendations of the Report, established the Technical and
Further Education Commission (TAFEC) to formulate and adminis-
ter the Commonwealth program of financial assistance. In the very
decade in which the economic downturn was most pronounced,
with high levels of unemployment and under-utilisation of
productive capacity, there was a dramatic change in the number
and size of technical institutions and in the student population
therein. By 1980 there were almost one million students in 1246
technical institutions, some 21% of these being major TAFE col-
leges.

There was corresponding increase in the status and scope of
Industrial Arts within secondary education. Depending on commu-
nity and school resources the subject embraced graphic arts,
ceramics, lapidary, leather work, plastics, farm mechanics,
bookkeepers and art metalwork additional to techins related to
wood and metal. In the senior secondary school engineering
science, technology and design are matriculation subjects. Moving
closer to industry is the stimulating pilot course "Industry
Studies Project" offered in some Sydney high schools to Years 9
and 10 students. The proponents of this course argue: "If our
education is to transmit culture then a study of industry is
surely of some importance. A student must benefit from an
understanding of our industrial and technological way of life."

As Australia moves into the 1980s the focus is on the implications for education and society of technological change. This is interpreted as part of a whole set of social changes which must affect schools and curriculum. Some of these social changes are interrelated, some are irreversible, some are tension ridden. It is ironic that rapid technological change is occurring within a nation beset with major social problems such as high unemployment, shortage and unequal distribution of non-renewable resources, concern about pollution and nuclear fall-out, changes in family patterns and sex roles, and the development of highly centralised organisations.

The relationship between technological change and education has been the subject of two reports commissioned by the Commonwealth Government in recent years. Each committee was bedevilled by the constant difficulty of welding together and fulfilling the several legitimate goals concurrently pursued by education systems and institutions.

The Committee of Inquiry into Technological Change in Australia (the Myers Report) perceived the relationship between technological change and education to be both simple and direct:

1. To benefit from technological change all members of the community require 'appropriate education and training'.

2. 'Appropriate education and training' rests upon a foundation of literacy and numeracy.

3. Study of the physical sciences and mathematics in the upper secondary school is the key to working and living in a period of rapid technological change.

4. The nation's primary school teachers must become mathematically oriented.

5. Girls must be involved in technological courses.

Prior to this, the Williams Committee had been asked to inquire into education, training and employment, not separately and fully in each case, but only in so far as it perceived a relationship to exist. The tendency of that Committee was to look at education as a vehicle to provide training for employment. This could be achieved through short intensive full-time courses to retrain workers affected by technological change or to upgrade the
existing skills of tradesmen. There was a plea for greater flexibility in technical education to achieve this. As did Myers, so did Williams stress the extent to which technology should be perceived as a system embedded in a social context.

There can be no doubt about the place and influence of technology in Australia today. The rate and level of adoption of new technology is the most important determinant of the state of the economy and is responsible for much industrial and social change. The low rate of development and adoption of technology by manufacturing industry has contributed significantly to its continuing decline. Technology is the cornerstone for successful and vital interaction between industrial development, societal change and education in Australia.