



INTERNATIONAL LABOUR ORGANISATION

ACT/EMP

PUBLICATIONS



HUMAN RESOURCE DEVELOPMENT FOR CONTINUED ECONOMIC GROWTH THE SINGAPORE EXPERIENCE 1997

Paper presented at the [ILO Workshop on Employers' Organizations](#)
in Asia-Pacific in the Twenty-First Century
Turin, Italy, 5-13 May 1997.

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1 INTRODUCTION

This paper will be in three parts. The first part will deal with the terminology used and the focus adopted. A historical outline of human resource development (HRD) against the background of economic growth will be covered in the second- part. In the third part the features of Singapore's HRD experience will be delineated. The paper will conclude with a short description of the value of the HRD experience of Singapore.

HRD in an integrated sense encompasses education and training, health care, nutrition, population polices and employment (Muqtada and Hildeman 1993; Working Group on HRD Strategies, Commonwealth Secretariat 1993). This paper will however deal only with education and training at the macro as well as enterprise levels. The other aspects of HRD, though important, will not be dealt with.

The education and training to be dealt with will be looked at from the perspective of how they relate to economic development. Thus the political, social and pedagogical aspects of education and training will be omitted.

2 HISTORICAL DEVELOPMENT

2.1 Independence and Industrialisation

2.1.1 Political and Economic Development

Singapore was founded by Sir Stamford Raffles in 1819. Together with Penang and Malacca, it formed the Straits Settlements in 1826. Jurisdiction of the Straits Settlements came under the Colonial Office in London in April 1867 when the Straits Settlements became a Crown Colony.

With its natural harbour and strategic location, Singapore prospered, developing rapidly as an entrepot centre for European and American trade with Southeast Asia and as a base for British political and military presence in the region. From 1942-1945 the Japanese occupied Malaya and Singapore. Following the return of British rule, Singapore became a separate Crown Colony in April 1946 while Penang and Malacca became a part of the Malayan Union. When the Malayan Communist Party, which had fought a guerilla war with the Japanese, mounted an armed insurrection to take over Malaya and Singapore, the British declared a State of Emergency in June 1945 which lasted for 12 years.

In the post-war years the largely entrepot economy of Singapore was unable to generate enough jobs for the thousands who were entering the labour market. Unemployment was high and rising (in 1957 the unemployment rate was 5% rising to 9.2% in 1966). There was an acute shortage of housing and inadequate health facilities. This was compounded by a high population growth rate of 4.4% per annum between 1947 and 1957.

Education was also inadequately developed. There were parallel systems of schooling: Malay schools established and supported by the Government; English schools founded by the Government and missionary bodies and supported by the Government; and Chinese and Tamil schools established and maintained by the Chinese and Indian communities respectively. Chinese schools, which had been left

very much to themselves, had been used by the Kuomintang after the Chinese Revolution in 1911 as incubators of the new Chinese nationalism. Chinese education became highly politicised. In the immediate post-war years the Chinese community felt that the British Colonial Government discriminated against Chinese schools and were out to destroy Chinese language, education and culture. It pointed out as evidence the Government's policy of subsidising English medium schools but not Chinese schools, the building of more English medium schools which drew students away from Chinese schools and the policy of requiring that one third of the curriculum time be set aside for the teaching of English in non-English schools. There was also unhappiness over the inability of many Chinese school graduates to secure public sector employment which required reasonable proficiency in English. Job opportunities in the private sector were limited, more so for Chinese school graduates.

The years immediately following the Second World War saw a political struggle for independence from the British with mass-based support from workers and students. The outlawed Malayan Communist Party, which had gone underground, infiltrated unions and Chinese schools and Chinese social and cultural organisations, exploiting anti-colonial feelings and social and economic grievances in the post-war era. As a result, the late 1940s and the second half of the 1950s were marked by industrial and student unrest. There were widespread strikes and even riots involving Chinese school students and Chinese speaking workers. In 1955 alone there were 275 strikes with a loss of 946,000 man-days.

In the meanwhile, following the recommendations of the British appointed 1953 Commission headed by Sir George Rendel, a new constitution was enacted for Singapore providing a greater measure of self government. The non-communists led by Lee Kuan Yew, together with pro-communists, formed the People's Action Party (PAP) in November 1954. In the 1955 elections the PAP won 3 of the 4 seats it contested. The Labour Front which won 10 seats formed a coalition government in April 1955 with the United Malay Organisation and the Malayan Chinese Association.

In 1955 the Legislative Assembly appointed an All-Party Committee to look into the situation in Chinese schools. The Report of the Committee recommended specific measures to deal with vernacular education in general and Chinese education in particular. It recommended parity of treatment for all streams of education and the provision of a common and nationally oriented curricula for all schools. Full aid was extended to Chinese schools. However the Education Ordinance, passed by the Legislative Assembly in 1957, giving the Government additional control over all schools was not implemented given the continuing political and industrial unrest.

On 28 May 1958 agreement was reached with the British for a new Singapore Constitution which provided for full internal self-government. External affairs and defence remained a British responsibility and internal security will be dealt with by an Internal Security Council, with equal representation from the Singapore and British Governments and a seventh member from the Federation of Malaya. The PAP contested the May 1959 election and won 43 of the 51 seats and formed the Government.

The uneasy alliance between the non-communists and procommunists in the PAP gave way to a struggle by the two factions for dominance on the political and trade union fronts. An open split developed in July 1961 when pro-communists were relieved of their government offices and dismissed from the PAP. The pro-communists in September 1962 formed the Barisan Socialist. On the trade union front, non-communists in the Singapore Trade Union Congress split with the procommunists to form the National Trades Union Congress. The Singapore Trade Union Congress was dissolved and the procommunists formed the Singapore Association of Trade Unions (SATU).

Meanwhile the Malayan Prime Minister had on 27 May 1961 proposed a merger of Malaya, Singapore, Sarawak, North Borneo and Brunei. On September 1962, 71% of the people of Singapore supported merger in a referendum on the merger. This was a major defeat for the Barisan Socialis which had campaigned against the merger. On 16 September 1963 Malaysia, consisting of Malaya, Singapore, Sarawak and North Borneo was formed. Indonesia and the Philippines were against the merger. President Sukarno of Indonesia worked actively against it during the three years of Indonesian Confrontation from 1963-1965.

In Singapore the PAP Government moved against the procommunists and their trade unions. On 2 February 1963 it detained key pro-communists and their sympathisers. The procommunist Secretary General of the Singapore Harbour Board Staff Association was charged with criminal breach of trust and the union was deregistered in July 1963. In August 1963 it served notice on seven SATU unions to show cause why they should not be de-registered. SATU called a 2-day general strike on 8 October 1963. It was unsuccessful and the seven SATU unions were deregistered. This effectively crippled the procommunist trade union movement.

Singapore separated from Malaysia and proclaimed its independence as a republic on 9 August 1965. The young republic faced daunting economic and social problems of slow economic growth, high unemployment, a high birth rate and inadequate education, housing and health. Its small economy was dependent on entrepot trade and British military spending. Entrepot trade did not have the potential for growth to absorb the massive and rising unemployment, as Indonesia and Malaysia upon their independence sought to trade directly with Europe and the United States. In 1967 the British Government announced its decision to withdraw British forces on a phased basis but completely out of Singapore by the end of 1971. British military expenditure in Singapore accounted for some 14% of GDP and was responsible for the direct employment of some 20,000 workers. Furthermore Singapore now had to shoulder the costs of its own defence.

The Government's strategy in the first half of the 1960s of import substituting industrialisation was changed in 1968 to one of rapid industrialisation through attracting foreign investment for export oriented and labour intensive manufacturing. A team of United Nations experts led by Dr. Winsemius had submitted its report in June 1961 on "A Proposed Industrialisation Programme for the State of Singapore" as a blueprint for the Republic's industrialisation. The export-led industrialisation strategy was supplemented by moves to develop Singapore into a regional and international financial centre. Foreign exchange controls were removed and various financial incentives introduced. The Asian Dollar Market was established in 1968. Efforts were also made to develop the tourist industry. A Hotel and Catering Training School was established to train manpower needed for the growth of the tourist industry.

The Government also pursued a vigorous family planning programme encouraging Singaporeans not to have more than two children and expanded housing and health facilities. It also took several measures to ensure orderly and peaceful industrial relations including promoting a responsible non-communist trade union movement; legislating an industrial relations system providing for the restoration of the management's common law rights and procedures for the prevention and speedy settlement of disputes; and introducing a policy of tripartite cooperation between the Government, employers and the unions. With the depoliticalisation of the trade union movement and the introduction of the foregoing measures, industrial unrest subsided. The number of strikes declined from 116 strikes with 410,889 man-days lost in 1961 to 4 strikes with 3,192 man-days lost in 1967.

On the political front the PAP won all seats in the 1968 election. The one party Parliament became the pattern, with the PAP winning all seats in 1972, 1976 and 1980. The PAP continued to govern

subsequently when in the 1984 and 1991 elections, it won all but two and four seats respectively. With its control of the Government, the PAP was able to plan, formulate and implement its economic development and HRD policies.

2.1.2 Education and Training for an Industrialising Economy

Where education and training was concerned, the Government embarked on an accelerated school building programme. School buildings were also used in double sessions, with one set of pupils in the morning and another in the afternoon. Primary school enrolment rose from 284,702 in 1960 to 371,970 in 1968. Secondary school enrolment also increased from 59,244 in 1960 to 150,641 in 1968. Large numbers of teachers were recruited and trained in service to meet the dramatic increase in school enrolment. Thus the number of teachers rose from 10,590 to 17,184 in 1965.

To accord parity of treatment to all streams of education, the Government developed a common education system. The measures taken included the change of the Chinese educational structure of 6 years of primary school, 3 years of junior middle and 3 years of senior high school to the English school system of 6 years of primary school, 4 years of secondary school and 2 years of pre-university education; the introduction of a common syllabus for all school subjects in the 4 language media; the training of teachers in 4 different languages; and the institution of common examinations for all 4 streams - the Primary School Leaving Examination, the School Certificate examination and Higher School Certificate Examination.

The secondary school system was restructured upon the recommendation of the 1961 Chan Chieu Kiat Commission of Inquiry into Vocational and Technical Education. Four other types of schools (ie. in addition to academic schools) were created at secondary level - vocational, technical and commercial schools and vocational institutes. The Balestier Junior Trade School was reorganised into a vocational institute in 1964. Nevertheless despite the addition of a technical bias, the secondary school enrolment remained predominantly academic. In July 1968, 83.9% of those enrolled in secondary schools were in the academic stream while 8.1% were in the technical stream, 7.1% in the vocational stream and 0.9% in the commercial stream.

Greater emphasis was given to technical education with the shift to export oriented industrialisation which took on greater urgency upon independence. In April 1968 the National Industrial Training Council was formed. Chaired by the Minister for Finance, with the Minister for Labour and the Parliamentary Secretary for Education as members, it was tasked with the responsibility for technical education and training. In June 1968 the Ministry of Education was divided into the General Education Department and the Technical Education Department. The Technical Education Department oversaw technical education and training.

The secondary school system was again restructured. Vocational schools were phased out. All secondary school students studied a common curriculum in the first 2 years. In addition to general subjects all pupils took technical drawing and all the boys and 50% of the girls underwent workshop practice once a week outside normal school time. The remainder of the girls followed a home economics course. These changes were designed to enable students not only to acquire literacy, numeracy and the ability to deal with concepts but also to introduce manual skills to them through workshop practice. A policy of having one third of the students in the technical stream and the remainder in the academic stream in the upper secondary classes was phased in. By 1972 this ratio had been achieved. The number of secondary four students in the technical stream rose from 1,600 in 1968 to over 7,000 in 1972.

Major changes were made to the industrial training system. The number of vocational institutes was increased from 4 in 1968 to 9 in 1972. The output of full-time graduates rose from 324 in 1968 to over 4,000 in 1972. From 1970 a module system of craft training replaced the 2 years full-time training for all students. Industrial training was broken down into small integral units. Courses offered ranged from 6 months to 2 years depending on the type and level of skills. Skills could be acquired in the minimum of time and progress from one stage to another stage was made possible. In 1969 the Singapore Technical Institute was set up to provide 2-year full-time technician courses to bridge the gap between the trade courses offered by the vocational institutes and the 3-year technician courses offered by the Singapore Polytechnic and Ngee Ann Technical College.

Responsibility for apprenticeship schemes was transferred from the Ministry of Labour to the Technical Education Department of the Ministry of Education. The department sought to improve and expand apprenticeship training. It introduced a 3-year training framework for apprenticeship in selected trade areas. Individual apprenticeship programmes were pursued with large local and multinational firms whose manpower requirements were sufficiently large, specific and continuous. Group apprenticeship training schemes were however offered to locally owned small scale industries. In 1970 a group training scheme was worked out with the Singapore Association of Shipbuilding and Ship-Repairing for the shipbuilding and repair industries. To encourage apprenticeship training, National Service training was deferred for 4 years for apprentices on programmes approved by the Technical Education Department.

To improve and better coordinate industrial training, the Industrial Training Board was set up in 1973 to take over from the Technical Education Department responsibility for industrial training. Six years later the Industrial Training Board merged with the Adult Education Board to form the Vocational and Industrial Training Board so as to rationalise the functions and resources of these two statutory boards.

In the meanwhile changes were also being made at the Singapore Polytechnic and Ngee Ann College to meet the new needs of the changing economy. In 1959 the Singapore Polytechnic abolished its general education, typing and stenography courses focusing instead on craft, technician and professional courses in accountancy, architecture and building. A local examination system with internal and external examiners leading to award of its own diplomas was introduced replacing the previous system of overseas examinations. This allowed courses to be tailored more to local needs and benefited Chinese stream students most of whom did not have the General Certificate of Education, a prerequisite for overseas examinations. In 1963 the Singapore Polytechnic transferred all its craft courses to the Vocational Institute at Balestier Road in accordance with the recommendation of the 1961 Chan Chieu Kiat Commission of Inquiry into Vocational and - Technical Education. The Commission's other recommendation that the Singapore Polytechnic be developed into a College of Advanced Technology was also accepted. In 1965 the University of Singapore agreed to award degrees to the Polytechnic's professional engineering, architecture and accountancy graduates. However in late 1968, the Government decided that the Polytechnic should concentrate on technician training. All the professional courses of the Polytechnic were then transferred to the University of Singapore. Student enrolment was expanded rising from 3,198 in 1969 to 7,546 in 1979. Noteworthy was the introduction in 1969 of the new 2-year full time or 4-year part-time Industrial Technician Certificate (ITC). A year shorter in duration than normal programmes, it provided basic engineering training to fit graduates into virtually any factory job requiring engineering knowledge and skills after some training in the company. By 1975 the Polytechnic had produced 2,057 ITC graduates when responsibility for the course was transferred to the Industrial Training Board.

Ngee Ann College, which was founded in 1963 as a private institution of higher learning for the Chinese speaking community, accepted the recommendation of the 1966 Report of the Thong Sau Pak

Committee of Review on the Future Development of Ngee Ann College that the College focus on the training of commercial and industrial technicians at diploma level instead of training professionals at degree level. In 1967 the College became a public educational institution with the enactment of the Ngee Ann College Act. In May 1968 the Government approved a grant of S\$363,000 to start a Mechanical Engineering diploma course and another S\$60,000 as recurrent expenditure for that year. In August 1968 the College's name was changed to Ngee Ann Technical College. The Government invited Mr Sung Sing-zak, Principal of Hong Kong's Technical College to be an adviser to the College from 1 September to 31 October 1968. Mr. Sung felt that the College should train more technicians to fill the gap between engineers and craftsmen. He recommended new courses in industrial electronics, management studies and institutional management. By April 1970 the College commenced with only 3 departments - Mechanical Engineering, Industrial Electronics and Commerce. By 1971 English was the sole medium of instruction and the first batch of non-Chinese students were admitted in April of that year. Student enrolment expanded from 754 in October 1970 to 2,103 in October 1979.

Meanwhile in tandem with changes in the national education and training system, the Economic Development Board initiated a number of manpower development programmes. Among these were two programmes designed to meet urgently needed technical training. One scheme was established in March 1968 to retrain clerical and other workers expected to be redundant upon the closure of British military bases. A total of 1,749 trainees were trained in skills like turning and fitting, sheet metalwork, plumbing and radio maintenance and repair. The other was the scheme to train welders in 1970 to meet an acute shortage of such workers. The increase in ship repairing following the closure of the Suez Canal, the establishment of the fabrication of oil drilling rigs and its assorted equipment industry to meet the needs of the burgeoning off-shore oil exploration in Southeast Asia and the expansion of the oil refining industry significantly increased the demand for welders. 1,789 welders were trained from 1970 to June 1973. The critical shortage of welders eased.

The Economic Development Board by 1968 also established 6 training centres with assistance from France, Japan, the United Kingdom and the United Nations Development Programme. These centres were the Metal Industries Ltd; the Prototype Production and Training Centre; the Electro-Mechanical Training Centre; the Electro-Chemical Engineering Centre; the Woodworking Industries Ltd; and the Precision Engineering Development Centre

The Economic Development Board set up the Engineering Industry Development Agency to oversee these centres which proved unmanageable and uneconomical. Between 1968 and 1972 only 86 trained personnel were produced at the cost of nearly S\$140,000 per trainee in government subsidy. The agency was converted into a business enterprise to survive on its own earnings.

The Economic Development Board also introduced the Industrial Development Scholarships Scheme which provided financial assistance to encourage MNCs investing in Singapore to send their key personnel overseas for in-plant training. By 1972 1,204 trainees had been sent under the scheme. It even launched a pilot scheme to attach apprentices in reputable companies in Germany and Switzerland for long term training to reach the respective national apprenticeship standards. The scheme was subsequently expanded.

Despite its abortive first attempt in setting up training centres, the Economic Development Board proceeded to set up 3 training centres in partnership with Arcs, initially on a single partner per institution basis and later on a multi-partnership approach. The Government provided concessions, and financial and other assistance while the MNC concerned set up the centre, seconded a director to run it, designed the training programmes and seconded lecturers to teach them and agreed to train twice the number required by the Singapore subsidiary of the MNC. Trainees underwent an apprenticeship

programme of 2 years in-centre training followed by a 2-year attachment in the MNC or other firms. They were paid a monthly stipend by the Government and were bonded to serve the MNC partner or other firms as directed by the Government for a period of 5 years after their in-centre training. Following training, trainees were deferred from full time National Service for a further 6 years. The MNC or firm concerned reimbursed the Government for the stipend paid. The 3 training centres were

1. the Tata-Government Training Centre which started operations in July 1972 to train tool makers;
2. the Rollei-Government Training Centre which commenced operations in July 1973 to train precision mechanics, precision opticians, toolmakers and electricians. When its parent company failed, its Singapore subsidiary, Rollei Singapore (Pte) Ltd. withdrew from partnership of the centre. Brown Boveri and Cie took its place in 1982. Renamed the Brown-Boveri Government Training Centre, it became the Precision Engineering Institute in October 1988 with the involvement of other MNCs. Subsequently the Tata Government Training Centre was absorbed by the Precision Engineering Institute. Some of the major projects in the Precision Engineering Institute involving other MNCs include the Siemens-Nixdorf-EDB Centre for Advanced Tool and Die Making, Mitutoyo-EDB Metrology Laboratory, the Bridgeport-EDB Numerical Control Laboratory and the Autodeck-PEI Computer Aided Design/Computer Aided Manufacturing Unit; and
3. the Philips-Government Training Centre which began in 1975 to train turning, metal working and sheet metalworking craftsmen.

These training centres later conducted programmes to upgrade the skills of craftsmen already in industry as well as provided technical services to small and medium sized enterprises.

Following successful negotiations with the Japanese Government, the Economic Development Board set up a Japan-Singapore Training Centre in 1979. It was upgraded in 1983 into the Japan-Singapore Technical Institute to train technicians to operate, troubleshoot and maintain automated machines, including industrial robots, computer numerical control machines, pneumatics and - microprocessor-controlled equipment.

Other manpower development initiatives by the Economic Development Board included the conducting of management training courses from 1962 to 1964 when these programmes were transferred to the newly founded Singapore Institute of Management and the establishment of the National Productivity Centre in May 1967 to raise labour productivity through promotion, training and consultancy. The National Productivity Centre was renamed the National Productivity Board and became a statutory body under the Ministry of Labour in May 1972.

2.1.3 The Economy in the 1970s

The Government's industrialisation strategy worked. During the period 1970-79 real GDP grew by 9.4% per annum. Singapore absorbed during this period an average of US\$0.3 billion of foreign direct investment (FDI) yearly making it the fifth largest recipient among developing countries. The entrepot economy was transformed with this injection of foreign capital and expertise. Manufacturing became the largest sector with its share of GDP rising from 20% in 1970 to 27% in 1979. Exports of goods made in Singapore became more important than re-exports. Domestic exports rose from 39% of total exports in 1970 to 59% in 1979. The share of re-exports fell from 61% in 1970 to 41% in 1979. The financial sector grew rapidly. The Asian Dollar Market grew from US\$31 million in 1968 to US\$38 billion in 1979. The commerce sector grew rapidly from a new source - tourism. The number of visitors grew from 500,000 in 1970 to 2.2 million in 1979.

Massive unemployment disappeared. Unemployment fell from 6.0% in 1970 to 3.3% in 1979. During this period a total of 430,000 new jobs were created, with the manufacturing sector generating nearly half of the new employment. Full employment was attained in the early 1970s and labour shortage and job hopping developed. Indeed to sustain the accelerating pace of economic growth, immigration laws were relaxed to allow an inflow of foreign workers which by 1973 totalled over 100,000 (out of a workforce of 800,000), most of whom were Malaysians. On the wage front the Government established in July 1972 the tripartite National Wages Council to ensure orderly wage increases.

The tight labour market pointed to the need for economic restructuring. Fear of massive unemployment arising from the unfavourable external economic environment resulting from the four-fold increase in the price of oil and the ensuing world recession of 1974-75 led the Government to concentrate on reversing the downturn in the economy (GDP growth dropped in 1974 to 6.8 % and then to 4.1% in 1975). A policy of moderating wage increases and allowing the greater influx of foreign workers was followed. However with the recovery of the economy in 1976 when GDP grew by 7%, prospects for economic restructuring brightened.

2.2 Economic Restructuring

2.2.1 Changes in Economic Development Policy

In 1979 the Government embarked upon a major restructuring of the economy into one which is higher value added, high technology and more capital intensive. This restructuring was driven by the decline in domestic labour supply arising from the Government's family planning programme (by 1980 the population growth rate had dropped to 1.2% per annum), competition from resource abundant neighbouring countries which were moving into labour intensive export oriented manufacturing and the threat of rising protectionism in industrialised countries.

Mechanisation, automation and computerisation of industry were promoted. Tax incentives were granted. A 3-year high wage policy was recorded by the National Wages Council for 1979 - 81. As a result labour costs increased sharply rising 10.1% annually between 1979 and 1984 compared to a yearly productivity increase of only 4.4%. A foreign worker levy was introduced in 1982 to discourage the use of skilled foreign workers.

2.2.2 Education and Training For a Middle Technology Economy

Manpower training and skills development were stepped up. In this regard a Skills Development Fund, which was recommended by the National Wages Council, was set up. A levy of 2% of a company's payroll for workers earning below S\$750 a month was levied on employers in 1979. This was increased to 4% in 1980. In 1985 the levy was reduced to 2% when the 2% payroll tax was suspended. A year later the levy was lowered to 1%. The salary ceiling for the levy collection was raised to S\$1,000 in April 1995 with the levy rate remaining at 1%. The monies from the Skills Development Fund were used to upgrade the skills of workers or to retrain retrenched workers to facilitate economic restructuring. Under its Training Grant scheme, it defrays up to 50% or 80% of the cost of training programmes of companies which are relevant to economic development. The number of training places supported by the Skills Development Fund increased from 32,800 in 1981 to 493,338 in 1995. The Fund also assisted companies in the development of company wide training plans.

It also supported the setting up of a number of industry-run training centres in industries like textile and garments, hotel, construction, banking and finance, retailers and jewellery. From 1986 the usage of the Fund was changed to training of workers rather than executive and managerial staff.

The Government moved to improve management of manpower development. In 1979 the Council for Professional and Technical Education was formed to coordinate all the Government agencies involved in education and training. Chaired by the Minister for Trade and Industry, its members included the Minister for Education, the Chairman of the Economic Development Board, the civil service head of the Ministry of Education and the heads of the 2 universities. The Council- for Professional and Technical Education's overall objective was to ensure that there was an adequate supply of professional, technician and skilled manpower to meet the needs of industry. It makes projections and recommends enrolment targets and the corresponding staffing and financial requirements for universities, polytechnics, and vocational and training institutes of the Vocational and Industrial Training Board and the Economic Development Board.

The training of technicians and engineers was greatly expanded to support the economic restructuring programme. Both the Singapore Polytechnic and the Ngee Ann Technical College, (which was renamed the Ngee Ann Polytechnic in 1981) expanded their staff, and their physical facilities like laboratories and workshops as well as made changes to their courses. Thus the Singapore Polytechnic incorporated computer technology in its regular courses and made a computer literacy course and a programme in supervisory studies compulsory for all students. In Ngee Ann Polytechnic a Centre for Computer Studies was set up in July 1982 and diploma courses in computer studies were started. Both the polytechnics opened their courses to GCE "A" level holders and certificate holders of the Vocational and Industrial Training Board. As a result of these developments, student enrolment rose dramatically in both polytechnics. Student enrolment in the 2 polytechnics rose from 11,105 in 1980 to 27,106 in 1989. The number of engineering students rose from 2,754 in 1978 to 6,519 in 1988. A third polytechnic, (Temasek Polytechnic) was established in 1990 to complement existing programmes and broaden the range of options offered.

Changes were made to the 2 universities and university enrolment, including that of engineering, was significantly expanded. In 1980 the National University of Singapore was formed with the merger of the University of Singapore and the Nanyang University. The National Technological Institute was set up in 1981 to conduct more practice-oriented engineering courses leading to degrees awarded by the National University of Singapore. The Nanyang Technological Institute first offered degree programmes in civil, electrical and mechanical engineering. Computer engineering and material engineering degree programmes were introduced in 1989 and 1991 respectively. In 1991 Nanyang Technological Institute was renamed the Nanyang Technological University to facilitate the introduction of other disciplines which were complementary to its programmes in engineering, technology and business. University enrolment rose from 9,200 in 1980 to 22,095 in 1989. The number of engineering students rose from 386 in 1978 to 2,418 in 1988.

To support the economic upgrading programme, the Economic Development Board proceeded to establish technical institutes which would train those with GCE "O" or "A" level qualifications for high skill occupations. These institutes were set up with assistance from the Japanese, German and French Governments. Some 3,800 trainees have been trained in these institutes since their inception.

The 3 institutes were:

- i. the German-Singapore Institute which started in February 1982 offering broad based but practical courses in advanced manufacturing and automation technology;
- ii. the French-Singapore Institute which was launched in August 1983 to train technologists in electro-technical engineering disciplines; and
- iii. the Japan-Singapore Institute of Software Technology which began in 1982 to train computer software and services manpower. It was transferred to the Singapore Polytechnic in April 1987.

The Economic Development Board fostered the involvement of various MNCs of different national origins in these institutes in the belief that the new knowledge and technology intensive industries would require expertise and resources beyond what a single partner could provide. Thus several MNCs like Hewlett-Packard, ASEA and Siemens-Nixdorf were involved with the German-Singapore Institute. The major projects established through this transnational approach were for example CAD/CAM by Prime-Computervision, Hewlett-Packard and Autodesk, robotics/vision technology by Asea, Seiko, Sankyo Seiki and Bosch and Laser Technology by Trumpf.

These transnational arrangements enabled the Economic Development Board to overcome the high costs of equipment, lack of expertise and rapid obsolescence associated with high technology training programmes. While Singapore benefited in terms of technology transfer and trained manpower, the MNCs were each able to use the equipment and facilities of the Economic Development Board's training institutes as well as those provided by other partners.

The Government also moved in the 1980's to improve the quality of primary and secondary education. The massive school expansion of the 1960s and 1970s and the depoliticisation of education have been acknowledged by the then Prime Minister, Mr. Lee Kuan Yew as a political football" as well as a "messy, massive exercise involving the mass production of schools and teachers and the juggling of languages of instruction" (Linda Low 1991, p. 55). The 1979 Report of the Education Study Team led by Dr. Goh Keng Swee (The Goh Report) identified the following as the major problems:

- i. high education wastage. The attrition rate was 29% for primary schools and 36% for secondary schools.
- ii. low literacy and ineffective bilingualism. A considerable percentage of students in schools did not meet the minimum literacy skills, with the situation more severe in the English stream. Furthermore less than 40% of each cohort population were able to attain the minimum competency level in two languages.

Other problems included the great variation in the academic performance of schools, the low morale of teachers and the ineffective leadership of the Ministry of Education.

The Goh Report argued that the existing system penalised the below average children and slow learners. It did not take into account the differences in absorption capacities and rates of learning. The Goh Report recommended that the high primary and secondary wastage can be reduced by streaming students into different courses according to ability. To ensure the attainment of literacy and numeracy, it recommended a concentration on the learning of languages and mathematics in the first 3 years of primary school.

The new education system implemented in primary schools in 1979 and secondary schools in 1980 saw students following a common curriculum from Primary One to Three. At the end of Primary Three students were streamed on the basis of their examination performance in Primary Two and Three to one of the three courses - the Normal bilingual course; the Extended bilingual course, and the Monolingual course. The Normal and Extended bilingual academic courses were basically academic in nature while the Monolingual course was a non-academic programme to teach basic literacy and numeracy to the less academically inclined and to prepare them for pre-vocational training at vocational institutes. Students who passed the Primary School Leaving Examination were streamed to one of the three courses:- the Special Course; the Express Course; and the Normal Course. The Special Course and the Express Course take 4 years to complete in the secondary school system whilst the Normal Course takes 5 years to complete and students in this course are awarded with a 'N' level certificate.

As a result of the educational changes following the Goh Report, attrition rates at primary and secondary school level dropped sharply. Compared to the previous rate of 29%, the attrition rate of the first cohort to be streamed at Primary Three (the 1977 Primary One cohort) was only 8%. Likewise the attrition rate of the first cohort to be streamed after the Primary School Leaving Examination into secondary schools (the 1975 Primary One cohort) was only 6% as against the previous rate of 36%. Even these attrition rates were overstated as the majority of those who failed the PSLE proceeded to vocational institutes which had been expanded. This success in reducing attrition rates was attested to by the fact that in 1986 only 3,772 students or less than one per cent of the total school population below 16 years of age left school without obtaining at least 10 years of education.

Meanwhile in 1985 the Singapore economy went into a severe recession contracting by 1.6%. In 1986 the economy grew only by 1.8%. In March 1985 the Government appointed an Economic Committee to review the progress of the Singapore economy and to identify new directions for its future growth. The Report of the Economic Committee recommended that Singapore become as developed economically as the West by the 1990s and yet more competitive. It proposed ways in which Singapore can prepare for this. Its recommendations for education and training included:

- i. upgrading the median educational level of the workforce (72.6% in 1980 had only primary or no education, and only 3.5% had university education);
- ii. providing continuous training and retraining of the workforce; and
- iii. expanding and improving education at the post-secondary and tertiary levels, and increasing their intake in particular.

The Government moved to upgrade the education and skills of the existing workforce. A series of national programmes were implemented through national training agencies like the Vocational and Industrial Training Board (later renamed the Institute of Technical Education) and the National Productivity Board (subsequently renamed the Singapore Productivity and Standards Board).

The trade union movement led by the National Trades Union Congress (NTUC) is also involved in worker training. It promotes skills upgrading among workers and pushes for more training by employers. In addition it undertakes worker training. For example it conducts classes to raise the English Language and Mathematics (BEST and WISE programmes see next page) and computer competency of workers. Most recently the NTUC launched in December 1996 the Skills Redevelopment Programme to help workers improve their employability. Involving initially ten local and MNC companies, it is targeted at workers who have been or are going to be retrenched, older and poorly educated workers who are forty and above years old as well as workers in their thirties (NTUC News Weekly, 1997). The programme is being conducted in cooperation with the Singapore Productivity and Standards Board, which will provide financial help and payment to participating workers, and the Institute of Technical Education which will formulate training curriculum and design customised training courses and certify the skills attained. Companies involved will encourage and identify workers for training, formulate training programmes and implement them. The Secretary General of the NTUC has announced that the programme will be eventually expanded to cover all unionised companies.

Two national programmes were launched to improve the literacy and numeracy of poorly educated workers. They are:

- i. The Basic Education For Skills Training (BEST) programme which was introduced in 1983 to upgrade the English Language and Mathematics competency of workers with less than Primary Six education to up to Primary Six level. As at March 1996 some 400,000 workers have enrolled for at least one BEST module.

- ii. The Worker Improvement Through Secondary Education (WISE) programme which was launched in 1987 for graduates of BEST programme and workers with only up to Primary Six education. It seeks to raise competency in English Language and Mathematics to Secondary Four level. As at March 1996 some 170,000 workers have enrolled in at least one module of WISE.

Various national programmes were also introduced to provide new skills to workers or to upgrade or update their existing skills. These programmes included:

- i. The Modular Skills and Training Scheme (MOST) programme which was started in 1986 for workers who wanted to acquire a new skill or upgrade an existing skill. A range of 128 modules of skills training is offered leading to a nationally recognised Certificate of Competency, a National Trade Certificate (NTC) Grade 3 or NTC Grade 2. As at October 1996 some 50,000 workers have benefited from the MOST programme.
- ii. The CORE Skills For Effectiveness and Change (COSEC) programme which began in 1986. It was designed to help worker communicate better, be competent in their jobs, solve problems relating to company's performance and be familiar with the computer. It was targeted at 300,000 clerical, sales, service, production and manual workers.
- iii. The Information Technology Programme for Office Workers (IT Power), which was jointly developed by the National Productivity Board, IBM and the National Computer Board, seeks to teach office workers the skills to operate PCs and common office computer applications. The target is to provide 50,000 training places between 1988-1993.
- iv. The Service Quality Programme which is conducted jointly by the National Productivity Board and Singapore Airlines. It is a company-wide programme to train staff within an enterprise to share the same service quality concept.
- v. The Training Initiative for Mature Employees (TIME) programme which was launched in 1991 to upgrade the skills of workers who were more than 40 years of age and deemed most vulnerable to economic restructuring and technology changes. Workers have a choice of the medium of instruction - English, Mandarin, Malay or Tamil. No prior qualifications are required and off-the-job training is conducted on company's time. As at October 1996 some 1,700 workers have benefited from the programme.

Greater emphasis was placed on developing Singapore's R & D capability to support economic restructuring. An emphasis on science and technology had already begun in 1968 when the Ministry of Science and Technology was established to promote the role of science and technology in the education system and the economy. In 1967 the Singapore Science Council was established as an advisory body on manpower training and R & D in industry. The Ministry was disbanded in 1981. The issue of developing R & D capability was the subject of the report of the Economic Committee. Its recommendations included developing competence in information technology, biotechnology, robotics and artificial intelligence, microelectronics, laser technology and optics and communications technology; the establishment of centres of competence in selected areas; greater community-industry interaction; and expansion of post-graduate education to train more research scientists and engineers.

As a result, a number of high technology research oriented institutes were set up including the Institute of Systems Science, the Institute of Molecular and Cell Biology, the Industrial Collaboration Centre of the National University of Singapore's Science Faculty, the Innovation Centre of the National University of Singapore's Engineering Faculty. Interaction between tertiary institutions, the Government and MNCs increased. The National University of Singapore forged new links with outside organisations and set up joint research committees with the Ministry of Trade and the Ministry of National Development. A Science Park was established to facilitate R & D activities. To boost R & D

manpower, the National University of Singapore expanded its Master and Doctoral programmes. In 1987 its intake of post-graduate students increased by 12% over the previous year.

Steady progress in R & D was made during the period 1978-1990. National R & D expenditure rose from 0.2% of GDP in 1978 to 1.0% of GDP in 1990. The number of people doing R & D work was 7,004 in 1990 up from 1,672 in 1978. The proportion of research scientists and engineers was 61% in 1990 compared to 49% in 1984. In terms of research scientists and engineers per 10,000 labour force, the number increased from 8 in 1978 to 78 in 1990.

2.2.3 The Economy in the 1980s

In the meanwhile the economy had recovered and grew at 9.7% per annum from 1987 to 1989. This meant that the economy grew at the rate of 7.4% per year for the 1980s. Singapore was the largest recipient of FDI among developing countries receiving an average of US\$2.3 billion of FDI per year.

Manufacturing remained the largest sector accounting for 28% of GDP in 1990. The trend was for the development of manufacturing services like testing, financing, warehousing and purchasing. Existing labour intensive industries like the consumer electronics and furniture industries upgraded and/or relocated parts of their operations to neighbouring countries. New industries like petrochemicals, biotechnology, aerospace and information technology were set up. The financial and business services sector grew to 26% of GDP. Tax incentives were given by the Government for the setting up of an overseas HQ centre and international purchasing offices.

Some 346,000 new jobs were created in the 1980s. The sources of new employment were more diversified - from not just manufacturing but also commerce and the financial and business services sector. Professional, technical, administrative and managerial workers formed 18.5% of the total workforce in 1988 compared to 13.7% in 1980. The number of blue collar workers declined from 40.4% in 1980 to 35.3% in 1988. White collar workers like clerks and sales and service personnel rose to 40.9% in 1988 from 38.2% in 1980.

The upgrading of the economy bore fruits. Productivity growth was 5.0% per annum in the 1980s compared to 4.3% per annum in the 1970s. It accounted for a larger share of economic growth, 55% in the 1980s compared to 45% in the 1970s.

There was also a marked improvement in the quality of the workforce. In 1970 some 83.6% of the labour force had less than secondary education. In 1990 the proportion fell to 53.6%. The percentage of those with university education rose from 2.4% in 1970 to 6.0% in 1990.

2.3 A Maturing Economy - Regionalisation. Attention to Services and Upgrading Local Industries

2.3.1 Towards a Developed Economy

In October 1991 the Government published the Strategic Economic Plan as the national guide for Singapore's next phase of economic development (Ministry of Trade and Industry 1991). The Strategic Economic Plan sets out eight strategic thrusts to turn the Republic into a first league developed nation within the next 30 to 40 years. Singapore aims to catch up (on a moving target basis) with the GNP per capita of the United States by 2030 or the Netherlands by 2020. These strategic thrusts are enhancing human resources; promoting national teamwork; becoming internationally oriented; creating a conducive climate for innovation; developing manufacturing/service clusters; spearheading economic redevelopment; maintaining international competitiveness and reducing vulnerability.

The key features of its economic strategy are an emphasis on both the manufacturing and service sectors, encouragement of local enterprises to diversify, upgrade and develop into strong export oriented companies and promotion of regional investments.

2.3.2 Education and Training for a High Technology Economy

Modifications were made to the primary and secondary education system set up following the Goh Report. The changes made as a result of the Report of the Review Committee on improving primary school education included:

- i. Provision of a two-stage primary school system with a foundation stage of 4 years and an orientation stage of 2 years. Streaming of pupils takes place at the end of the foundation stage at Primary Four instead of streaming at Primary Three; and
- ii. Modification of the Primary School Leaving Examination from being an achievement test to a placement test to enable students to proceed to secondary school.

These changes in the primary school led to the introduction of a Normal Technical Stream at the secondary level. The Normal secondary course now consists of the Normal Academic and the Normal Technical streams. This will cater to the range of abilities and aptitudes among such students, and expand their opportunities for vocational and industrial training at secondary and post secondary levels.

With these changes all students will get at least 10 years of general education - 6 at primary and 4 at secondary. By 1997 these changes will be fully implemented when students in Primary Four in 1991 reach Secondary Four. By then the percentage of each cohort of students who will complete secondary education will rise from 80% in 1990 to over 90% in 1997.

Future plans for improving primary and secondary education include:

- a. turning all secondary schools into single session by the year 2000 A sum of S\$1 billion will be used for the purpose;
- b. spending S\$1.5 billion over the next 5 years to put computers in all schools; and
- c. promoting the creativity, independent learning and thinking skills in students. Examinations will test students' ability to handle open-ended questions and greater weighting will be given to the assessment of project work. The curriculum will also be lighter.

In the 1990s the Government concentrated further on post-secondary and tertiary education to develop the manpower needed for the push to high technology and knowledge intensive products and services which are a feature of a developed economy. The Government's plan for post-secondary education was that by the year 2000 the proportion of each cohort proceeding to post-secondary education and training institutions should be 25% for technical institutes of the Institute of Technical Education, 40% to the polytechnics, and 25% to pre-university junior colleges.

In 1992 the Institute of Technical Education was established to take over the functions of the Vocational and Industrial Training Board and to provide technician training for secondary school leavers with "O" and "N" level qualifications. Its 3 existing institutes were upgraded and 7 new institutes are being built. With 10 institutes, the Institute of Technical Education will be able to enrol about 10,000 to 11,000 secondary school leavers or about 25% of each cohort. The Institute of Technical Education upgraded its courses to make it more appropriate for secondary school students.

Where polytechnic education was concerned, the Government set up in 1994 the fourth polytechnic, Nanyang Polytechnic, to provide a wider variety of courses. The polytechnics' mission is to train middle level technical and professional personnel. They had by November 1993 trained some 80,000 personnel. By the year 2000, they can be expected to train another 80,000 for industry.

With the restructuring and expansion of the post-secondary technical and vocation education system, the Government integrated the training institutes of the Economic Development Board into the Institute of Technical Education and the polytechnics. The Precision Engineering Institute and the Philips-Government Training Centre were amalgamated into the Institute of Technical Education's network of technical institutes. The 3 technical institutes - the French-Singapore Institute, the German-Singapore Institute and the Japan-Singapore Technical Institute were transferred to Nanyang Polytechnic to form the core of its School of Engineering.

While no longer running training institutions, the Economic Development Board plays a catalytic role in manpower and capability development for the 1990s. It administers the International Manpower Programme which assists organisations to recruit overseas professionals with critical skills. Under its capability development programme, the Economic Development Board arranged specialist manpower development programmes to strengthen Singapore's design and process capabilities in higher value added industries like precision engineering, tool and die design, IC design, automation, robotics, CAD/CAM/CAE, surface mount technology, process control, radio frequency technology and plastics technology. These programmes are developed in cooperation with relevant Government agencies, tertiary institutions and the private sector where relevant. Thus the Economic Development Board played a pivotal role in the establishment of the Precision Engineering Development Centre which will spearhead the technological and capability development of an industry vital to the whole of the manufacturing sector. Likewise to support Singapore's development as an international business hub, a programme to train personnel in logistics management was launched.

The Economic Development Board also announced in 1996 the setting up of an International Business Institute in conjunction with the National University of Singapore to train manpower required by companies which were going regional. Companies can also apply to the Economic Development Board for grants to defray the cost of training and developing manpower for regional projects. In 1996 a scheme was also launched to award 100 scholarships over the next 5 years for university studies in Singapore and overseas. The aim was to provide promising local enterprises with a pool of trained middle managers and engineers. The Economic Development Board funds 60% of the scheme whilst the rest was provided by promising local enterprises.

Initiatives were also taken to boost training by companies. The National Productivity Board sought by 1995 to double the percentage of payroll spent by companies on training from 2% in 1991 to 4% by 1995. By 1995 companies in Singapore had invested 3.4% of their payroll on training. However companies with 500 workers and more invested 7.2% of their payroll on training while those with less than 25 workers spent only 1.4%.

To promote training by smaller companies, the National Productivity Board launched in 1993 a national OJT programme. It had found that while 90% of companies had OJT, it was not necessarily structured and that more often than not workers were left to chance to acquire skills during the course of their job. The long term plan is to train 100,000 in structured OJT by the year 2000. A three pronged approach was adopted viz.

- i. Development of model OJT schemes with leading companies in a variety of industries for use by others. By 1995, 20 OJT models have been developed.

- ii. Assistance to companies to institutionalise OJT. A pool of some 100 consultants has been trained by April 1996 to assist companies to set up, run and institutionalise OJT programmes.
- iii. Assistance to companies that do not have skilled staff to undertake training. The National Productivity Board will train some 500 OJT instructors and make them available to industry.

The Government in August 1995 announced the setting up of a committee to see how best to build a better infrastructure for widespread continuing education for workers. The Singapore Productivity and Standards Board, founded in April 1996 through a merger of the National Productivity Board and the Singapore Institute of Standards and Industrial Research, will develop a national skills recognition system which will provide workers with a clear skills progression path that maps out existing and emerging skills and their relationships, possible acquisition routes and certification requirements. The system will encourage more skills upgrading by workers. The Productivity and Standards Board will also undertake manpower planning to meet the in-employment manpower needs of industry. A national manpower plan will be developed to provide directions, policies and plans for developing the whole workforce.

The Institute of Technical Education launched a restructured apprenticeship programme in October 1990 modelled after the Baden-Württemberg version of the Dual System. The programme involves on-the-job training in the company where the apprentice is employed and off-the-job training comprising theory and workshop practice in a vocational institute of the Institute of Technical Education or an approved training centre. The Institute of Technical Education provided training to upgrade the pedagogic competence of industry trainers. The scope of the apprenticeship programme was extended to include service skills such as retail sales, health care and travel and tourism.

Early in 1991 the Government set up the National Science and Technology Board. This Board produced in August 1991 the National Technology Plan 1991 outlining a comprehensive and coordinated national strategy for R & D for the next 5 years. The plan emphasised the role of R & D in providing industrial competitiveness. The list of selected technologies, which had been identified by the Economic Committee, was expanded to include food and agrotechnology, manufacturing technology, materials technology and medical sciences. The major recommendations of the plan were:

- i. Establishment of a S\$2 billion R & D fund to promote industry driven R & D;
- ii. Provision of grants and fiscal incentives to encourage more private sector R & D;
- iii. Assistance in the development and recruitment of R & D manpower;
- iv. Support for the establishment and funding of research institutes and centres; and
- v. Help in infrastructure support and the commercialisation of research findings.

3 targets were set for achievement by 1995 - a national R & D expenditure of 2%; 50% private sector share of total R & D expenditure; and a ratio of 40 research scientists and engineers per 10,000 working people.

Considerable progress was achieved in R & D from 1991 to 1995. National expenditure for R & D rose to 1.12% in 1994, short of the target of 2%. However the number of research scientists and engineers per 10,000 workers reached 41.9 in 1994. In 1994 the contribution of the private sector towards total R & D expenditure was 62.7%.

A technology infrastructure of 13 research institutes and centres to support R & D by industry has been set up. Virtually all these research institutes and centres were associated with the 2 universities. Strategic research and R & D relevant to Singapore's economic strategy were fostered in the 2 universities. A network of international linkages for a collaborative R & D was established.

In August 1996, the National Science and Technology Board announced its National Science and Technology Plan (NSTP) 2000 for the next 5 years. The vision for the next 10-15 years is for Singapore to build world class science and technology capabilities in areas which best support the Republic's key industries and spur the growth of new high value added industries. A S\$4 billion R & D Fund will be provided.

By the year 2000 the national R & D expenditure should be 1.6% of GDP while the number of research scientists and engineers per 10,000 working population will be about 65. The NTSP 2000 identified 4 main challenges in R & D:

- i. Meeting the demand for manpower. Another 5,000 research scientists and engineers will be needed for the next 5 years. The proportion of postgraduate researchers will be raised to 60% by the year 2000. Measures will be taken to expand the enrolment in science and engineering in the 2 universities, encourage postgraduate training and motivate young Singaporeans to take up careers in R & D. Foreign R & D manpower will also be tapped. The 2 universities will seek to attract about 20 experienced first rate R & D leaders and research professors to help set up world class research laboratories, lead complex R & D programmes and train local R & D personnel.
- ii. Strengthening technological capability. More resources will be spent to deepen and expand the R & D capabilities of the 2 universities and 13 research institutes and centres. To foster greater orientation to the needs of industry, a buyer-seller relationship between the universities and the research institutes and centres and industry will be encouraged. The Government devote 30% of the monies in the Fund to long term R & D projects in areas which will best help key industries to pre-position themselves for the next generation of products and processes. By the year 2000 the 2 universities should have 12- 15 first class research centres.
- iii. Making it conducive for industry to undertake R & D. More R & D grants will be made to promote R & D by industry. For short term technologies, co-funding will be up to 50% while for projects strategic to the economy, the funding can be more. R & D grants will also cover technology acquisition. Assistance will be provided for technology sourcing through organising technology brokerage events with technology rich countries and the establishment of a national repository for new and emerging foreign technology. In this connection it should be pointed out that the Economic Development Board launched in 1995 a S\$500 million Innovation Development Scheme to promote innovation projects in both service and manufacturing companies. Companies can apply to defray up to 70% of the cost of innovation projects.
- iv. Fostering technology innovation and commercialisation. A process to match technological innovations to industry requirements will be evolved and an environment conducive to technological start-ups developed.

The development of the formal education and training system has been paralleled by a proliferation of off-the-job courses of varying duration. There were distance learning degree programmes conducted by overseas universities. Many of these programmes offered MBA and Masters degree programmes. An open university was started in 1994 by the Singapore Institute of Management with the support of the Government to provide undergraduate degree courses. Furthermore each year some two to three thousand Singaporeans proceed overseas for university study.

3 FEATURES OF SINGAPORE'S HRD EXPERIENCE

The foregoing account shows that Singapore has invested heavily in the education and training of its people since internal self-government was achieved in 1959. Public expenditure on education as a percentage of GDP has risen from 2.8% in 1980 to 4.1% in 1995.

The features of Singapore's experience in education and training are as follows:

- i. The Government played the lead role in the development of education and training in Singapore. It laid down the policies, provided the funds for their implementation and set up the relevant institutions where necessary. However the employers, the unions and academia were consulted in the formulation and implementation of these policies.
- ii. The current and future needs of the economy as defined by the Government determined largely the development of the education and training system in Singapore. Employers' immediate training needs are only one input of the longer term plan to improve the education and training of new job entrants and to upgrade the skills of existing workers.

However the Government works closely with the private sector to ensure that its education and training system meets the needs of industry. Employers' representatives sit on the policy making bodies of education and training institutions. Industry advisory committees comprising industry representatives have been set up to ensure that courses are relevant and up-to-date.

- iii. The Government first concentrated on the provision of primary and secondary education in the 1960s and 1970s to lay the foundation for skills upgrading. From the 1980s onwards it sought to improve the quality of primary and secondary education to strengthen this foundation. Attention to tertiary education only picked up from the 1980s.
- iv. A technical education and training system was developed in tandem with economic development. It began with an early emphasis in the early 1960s when a technical bias was introduced in the secondary school system followed soon by greater emphasis from the late 1960s on. The technical education and training system was upgraded as Singapore moved towards middle and later high technology manufacturing.
- v. Singapore was prepared to develop new initiatives in industrial training outside the formal education and training system to provide the skilled manpower for its industrialisation. The training centres and institutes of the Economic Development Board provided some of the much needed manpower early in each of the industrialisation phases. They contributed to the success of labour intensive industrialisation of the 1960s and the upgrading of the economy in the 1980s. These manpower development initiatives were later integrated into the formal system when the technical education and training systems were developed.
- vi. The Government has collaborated closely with foreign governments and MNCS in the development of industrial training. It has sought to tap their expertise in training and in higher technology production and services so as to transfer "the hardware, software and teachware" required for the development of knowledge and technology intensive industries. The collaboration with foreign governments and MNCs continue.
- vii. A sectoral approach to education and training is adopted. Attention was given not only to the education and training of future job entrants but also to the education and skills of the existing workforce. The Institute of Technical Education and the Singapore Productivity and Standards Board have extensive programmes to upgrade the skills of the existing workforce. The Government remains especially concerned with the group of older workers who have primary or

less education. In this connection, it should be pointed out that the trade union movement led by the NTUC promotes skills upgrading among workers, pushes for more training by enterprises and undertakes worker training.

- viii. Experienced and well qualified overseas personnel have been actively and systematically recruited to supplement its limited pool of domestic human resource. Assistance is also provided to help these foreign staff settle into Singapore. Such overseas manpower have reduced the learning period of young Singaporean technicians, engineers and scientists. Some of these overseas personnel have played critical roles in Singapore's acquisition of competence in new high technology areas. Active recruitment of these overseas professionals continues.
- ix. Singapore has studied the experience of industrialised countries like Japan, Germany and Switzerland, identified their best practices and used them to help develop its education and training system. Thus for example it looked at the educational practices in the teaching of the working language and mathematics of Germany and Japan. It also learnt from Germany's 'dual' apprenticeship system and Japan's on-the-job training programmes. It therefore avoided the cost and complications which invariably arise from trial and error.

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4 CONCLUSION

The Task Force on Institutional Reform on Productivity and Quality Improvements is of the view that Singapore is now at the early part of the innovation-driven stage of national competitive development [Porter in his 1990 book on Competitive Advantage of Nations theorises that there are four distinct stages of national competitive development: (i) factor-driven; (ii) investment-driven; (iii) innovation-driven; and (iv) wealth-driven. There is successive upgrading of a nation's competitive advantage in the first 3 stages which is usually associated with progressively rising economic prosperity. The fourth stage is one of drift and ultimately decline]. Singapore no longer can just rely on labour or capital inputs for its future economic progress. Its labour supply is limited and there will be diminishing returns with greater usage of capital investments. Instead it has to concentrate on improving Total Factor Productivity (TFP) growth, i.e. the qualitative aspects of improvement, making best use of labour and capital resources to generate greater output per unit input.

The Task Force has identified manpower development as one of the three factors for raising its TFP growth. The other two factors are managing economic restructuring (upgrading and restructuring all industries) and accelerating technical progress (technological diffusion and application). Singapore's emphasis on HRD will therefore continue into the 21st century.

Singapore's past HRD experience (both achievements and mistakes) and its pre-positioning of its education and training system for its economic development into the 21st century provide invaluable lessons for other developing countries. Not all its experiences are applicable, but the principles, approaches and institutions adopted are worth consideration and with adaptation they may be useful to other countries.

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Director, Asia and Pacific
Information and Consulting Services Pty Ltd
2 January 1997

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TABLES
Table 1**GROSS DOMESTIC PRODUCT BY SECTOR (%)**

	1960	1970	1980	1990	1995
Manufacturing	12	20	28	28	29
Construction	4	7	6	5	7
Commerce	33	27	21	16	16
Transport & Communications	14	11	14	13	17
Financial & Business Services	14	17	19	26	22
Others	24	18	12	12	9
Total	100	100	100	100	100
Nominal GDP (S\$billion)	2.1	5.8	25.1	67.7	118.6

Source: Department of Statistics, Singapore *Yearbook of Statistics, various years*

Table 2**EDUCATIONAL PROFILE OF LABOUR FORCE**

Level	1970	1980	1990	1996
Below Secondary	83.6	72.6	53.6	38.9
Secondary	14.0	16.2	28.4	30.5
Post-secondary		7.6	12.0	18.9
Diploma				
University	2.4	3.5	6.0	11.6

Sources: *Census of Population (1970; 1980 and 1990, Singapore and Ministry of Labour (1996), Singapore*

Table 3**EDUCATION PYRAMID 1960 -1989 (% of Total Enrolment)**

	1960	1969	1979	1987	1988	1989
Primary	80.9	69.0	58.4	49.0	48.2	47.8
Secondary*	16.8	27.8	34.7	38.0	37.6	37.0
Technical & Vocational	0.0	0.8	2.8	4.6	5.5	5.6
Tertiary	2.3	2.4	4.1	8.4	8.7	9.4
Total	100.0	100.0	100.0	100.0	100.0	100.0

* Comprises academic, technical, commercial and junior colleges

Source: Department of Statistics, Singapore *Yearbook of Statistics, various years*

Table 4**PRIMARY AND SECONDARY AND PRE-UNIVERSITY ENROLMENT 1985 - 1995**

Level	1985	1990	1991	1992	1993	1994	1995
Primary	278,060	257,932	260,286	262,599	261,534	251,097	261,648
Secondary	164,168	161,029	157,528	156,362	155,834	174,483	181,548
Pre-University	26,160	30,430	28,431	25,787	24,895	23,498	22,114

Source: Department of Statistics, Singapore *Yearbook of Statistics 1995*

Table 5

**ENROLMENT IN TECHNICAL INSTITUTES, POLYTECHNICS AND UNIVERSITIES
1985 -1995**

LEVEL	1985	1990	1991	1992	1993	1994	1995
Technical Institutes	21,161	29,102	28,871	28,155	24,954	21,104	9,476
Polytechnics	21,610	29,550	32,312	35,517	40,358	43,227	46,841
University	18,303	26,122	27,913	29,842	32,468	33,243	34,591

Sources: Ministry of Education, Singapore Education Statistics Digest 1995, and Department of Statistics, Singapore *Yearbook of Statistics 1995*

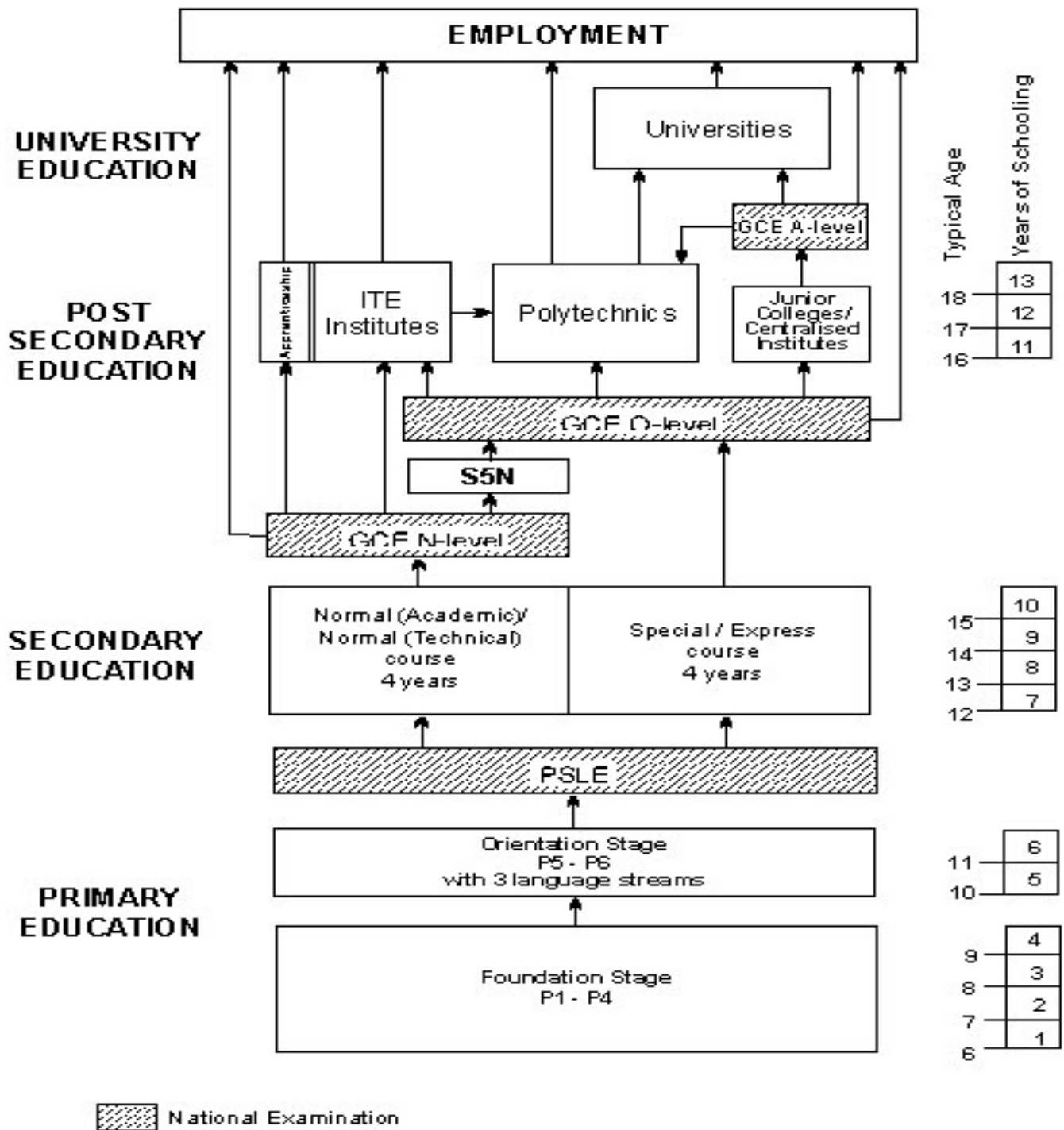
Table 6**GOVERNMENT EXPENDITURE ON R & D (GERD) AS % OF GDP IN SELECTED ECONOMIES**

Country/Economy	Year	GERD as % of GDP
1 Japan	1993	2.73
2 Germany	1995	2.30
3 Republic of Korea	1994	2.60
4 Singapore	1994	1.12
5 Sweden	1993	2.99
6 Taiwan	1994	1.80

Sources

- Indicators of Science and Technology, Republic of China, 1995
- Science & Technology in Korea, 1995, MOST, Republic of Korea
- OECD MSTI Database, from The European Report on Science and Technology Indicators 1994, European Commission
- National Survey of R & D in Singapore, various years, National Science & Training Board

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For further information, please contact Bureau for Employers' Activities (ACT/EMP).