EDUCATION AND INDUSTRIAL GROWTH IN TAIWAN: A CASE OF PLANNING

Jennie Hay Woo

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Robert C. Young
Senior Employment Policy Advisor
Agency for International Development
S&T/RD/EED
Room 622, SA 18
Washington, DC 20523

Donald R. Snodgrass
EEPA Project Coordinator
Harvard Institute for
International Development
One Eliot Street
Cambridge, MA 02138

ABSTRACT

A very important reason for Taiwan's industrial success was the ability of small and medium enterprises to compete as flexible-niche producers in export markets. An educated work force is a prerequisite for the competitiveness of such an industry strategy.

This paper examines the unique factors of the educational system that were crucial to Taiwan's economic success. First, it inherited an infrastructure from the Japanese that was built for basic education and extended fairly broadly among the population. Second, a ready supply of highly educated manpower arrived in 1949-1950 from the Mainland to begin the process of industrialization. Third, the education system grew steadily but in a manner that closely matched the changing requirements for industry.

The paper also examines Taiwan's current manpower training programs aimed at generating a greater supply of technical and scientific manpower to sustain its economic growth potential.

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I. Introduction

By all apparent economic measures, Taiwan has had extraordinarily successful economic growth in the past thirty-five years. On top of that, the wealth which was created has been distributed fairly equally among income groups. The reasons for this economic success have been attributed to Taiwan's emphasis on labor-intensive export industries, its attention to land reform and agricultural productivity, the spread of decentralized rural industry, and the small average firm size. While these factors are of great significance, the role of education has also been instrumental in Taiwan's successful economic growth. Taiwan's economic success was based upon a literate workforce. It is worth examining to find out what made educational development in Taiwan different from other similar developing countries, how that contributed to Taiwan's economic success, and how it must change in the future to ensure continued economic growth.

This paper will consist of two parts. The first is an anlysis of three unique factors of the education system which were crucial to Taiwan's economic success. The second part will examine Taiwan's current education problem -- how to continue economic success by generating a greater supply of technical and scientific manpower.

Taiwan's manpower resources had some unique features which gave it advantages over other resource-poor developing countries at the same stage of development. The country had a good

educational infrastructure left by the Japanese, an influx of skilled managers, technicians and entrepeneurs from the Mainland in 1949, and a supply which was carefully planned through the years to meet the country's economic manpower needs. These three elements, it is argued here, were crucial in allowing the country to industrialize as quickly and successfully as it did.

Infrastructure Left by the Japanese

The Japanese colonists had put in place an education system that while limited mostly to primary level, still left Taiwan with one of the most literate populations in Asia. In 1950, the first year for which data is available, Taiwan had 1,231 elementary schools, 77 vocational schools, 6 colleges or junior colleges and one university.([1]) It had over one million students attending school at elementary level or above, making a student to population ratio of 140.

The gross enrollment ratio (the ratio of school enrollment to the population of school age) in 1950 was 80% for the first level, a very high figure for a country just emerging from wartime destruction. This put Taiwan far ahead of the rest of China and most of Asia in the proportion of its population receiving some education. Malaysia's enrollment ratio was 39% and Indonesia's was 45%. Hong Kong had a ratio of 61% in 1955. Taiwan also already had a major university, founded by and for

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[1]. Ministry of Education, Educational Statistics of the Republic of China, 1987.

the Japanese colonists, which when taken over by the Taiwanese, became the country's first national university.([2])

Influx of Mainlanders

The Japanese, while they did build up a basic education system of sorts, held all the management and entrepeneurial posts in colonial Taiwan. The Japanese had to leave abruptly in 1945 with the ending of the war. In the late 1940's, when it became apparent that the Nationalists would not hold the mainland, a large number of refugees escaped to Taiwan. From 1946 to 1950, Taiwan received more than one and a half million refugees from Mainland China, increasing the population by 25%.([3]) Among them were administrators, technicians, and doctors - many of China's elite educated class. They were able to fill the places which the Japanese had left. Unlike the Japanese, however, they were part of the same broader culture as the local Taiwanese and would rebuild the economy as an integral unit, rather than as an appendage to the Japanese economic system. Consequently, in the initial stages of industrialization there was not a severe lack of administrative manpower, as is often the case in developing countries.

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[2]. Taihoku National University was founded in 1928 and became National Taiwan University.

[3]. Ho, Samuel P.S. Economic Growth and Structural Change in Taiwan, 1869-1970, Yale University Press, New Haven, Conn., 1978 p.105 and Galenson, Walter, ed. Economic Growth and Structural Change in Taiwan, Cornell University Press, Ithaca, N.Y. 1979.p.454.

II. Well-Planned Education System

The final crucial factor in the development of Taiwan's human resources was its carefully planned education system. We shall examine it in detail.

Brief Description of School System

Taiwan's education system has three levels - primary, secondary and higher. The primary level is for children 6 to 12 years old. The secondary level is made up of three years of junior high school and three years of senior high school or vocational school. (See Figure 1.) The first nine years of school, six years of primary school and three years of junior high, are tuition-free and compulsory. All students who desire to continue schooling must sit for an exam after junior high school. This determines whether they enter a senior high school (which tends to be university track), a senior vocational school or a five-year junior college (usually vocational track). After senior high school or senior vocational school there is a unified university entrance exam and a two- or three-year junior college entrance exam.(*)

The vocational track is very large in Taiwan. Currently, about 45% of Taiwan's higher education students are in university (all degree levels) and 55% are in junior colleges. The proportion of students who reach higher education is fairly

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*. There are also additional schools in the Taiwanese educational system which this study will not deal with since they are special schools serving a small minority of pupils. They are kindergartens, schools for the handicapped, and general and vocational supplementary schools.

large. In 1986, about 75% of junior high graduates went on to senior high, senior vocational or five-year junior colleges. About 82% of senior high graduates (including previous years) went on to university, college or junior college. However, there are some major quality distinctions.

At the senior high and senior vocational school level and above there are many private schools (see Table 1). In fact, in higher education more students are enrolled in private than public schools. In 1986-87 there were 53,536 public junior college students and 190,946 private students. Private schools are managed independently but they are strictly regulated by the government. The government dictates not only enrollments, curriculum, and degree requirements, but even the fees private schools are allowed to charge. Private schools, in turn, receive government funds but for the higher levels the percentage of the budget allocated to private schools is far below the share of students enrolled in that sector. Private universities and colleges, which enroll 60% of students in higher education, get only 26.4% of the higher education budget. (See Table 2) Senior high schools are a notable exception. There, the private schools enroll 24.3% of senior high school students, but receive almost 40% of the budget.

Brief History

The principal change in Taiwan's education system since 1950 has been phenomenal growth. Some argue, in fact, that one key to

Taiwan's rapid and equitable growth has been the continual rise in the education levels of its workforce.([5])

As shown in Table 3, Taiwan achieved universal primary enrollment (98%) in about 1970. Secondary level reached 80% enrollment in 1980. Third level enrollment rates increased steadily to 14% for men, 12% for women in 1985, with the gap between male and female rates gradually diminishing. In 1968, junior high school became free and compulsory schooling was extended through junior high to make nine years of national education. Thus enrollment and enrollment rates in junior high schools jumped up in the 1968-69 academic year and continued to climb rapidly. The average annual increase for the decade 1960-69 was 12.7%. (See Table 4) In 1965, the five-year junior college was introduced and thus that level began to expand very rapidly, especially after 1968, when it absorbed many of the new junior high graduates. The junior college rate of average annual increase for 1960-69 was almost 34%.

In general, the percentage increases were quite high in the early years, since the base was so low, and high in absolute numbers in the 1960 - 1969 decade. 1972 marked one peak in primary school student enrollment, after which the numbers began to decline. This was because universal enrollment had been reached and the birth rate was declining. The birth rate did jump up in 1976 and caused another rise in the 5-9 year

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[5]. Hou, Chi-ming, "Education, Manpower and Growth with Equity: The Case of Taiwan" Academia Economic Papers, Vol.8, No. 1, March 1980.

population and in primary enrollments around 1982. In 1980, the birth rate began to decrease again and this will be reflected in primary enrollments in 1987 and 1988. The virtual standstill in expansion of senior high compared to senior vocational enrollments will be explained below.

From 1966 onwards, educational expansion in Taiwan has been guided very explicitly by a manpower development plan (MDP). The first plan was developed by a team from the Council for International Economic Cooperation and Development (CIECD), now the CEPD (Council for Economic Planning and Development). They were assisted by experts from the International Labor Office and the U.S. Department of Labor. They developed the plan from economic projections of growth by industrial sector and then derived projections of occupational requirements for various education levels. They had specific targets for employment levels (usually keeping unemployment at 3% or 4%) and for reducing the share of employment in agriculture and increasing it in industry and services. To do this, the plans set enrollment distributions between senior high schools, senior vocational schools, and junior colleges, between various departments in universities and colleges and eventually set enrollment quotas. The plans also set an index for total expenditure on education as a proportion of GNP. From this, the Department of Education would set fees and enrollments for the specific schools, both public and private, at all levels.

The First MDP was promulgated in October 1966 and the

subsequent plans were formulated roughly every three or four years after that.([6]) An important feature of these plans was that they were actually implemented. The planning process mobilized the various sectors of the government into discussion and negotiation about various issues that needed to be addressed. But unlike many government plans, once they were agreed upon, these plans were then implemented according to a strict time-table with deadlines. Specific agencies were made responsible and other agencies were required to oversee them.([7]) And in fact, as explained below, the enrollment and budget statistics do bear evidence that most plan targets were met.

The most important result of the First MDP was the shift in emphasis in Taiwan's educational system, from general to vocational education (see Table 5). In 1963, 40% of high school students were in vocational schools (more than half of those were business) and 60% were in senior high schools, studying a more general curriculum. The First MDP set a target of 60% vocational and 40% senior high. This emphasis was continued in subsequent MDP's. In 1972 the actual ratio was 52:48 (vocational to senior high) and by 1980 it was 66:34, almost the Fifth MDP target of 70:30. This policy was designed specifically to meet the greater economic demand for semi-skilled labor. It was a deliberate and

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[6]. See Hou, Chi-ming, "Manpower Planning and Development in Taiwan" in Industry of Free China, August and September, 1978.

[7]. See Table Displaying Division of Labor for Mid-Term Plans and Policies (in Chinese), Council for Economic Planning and Development, Republic of China, Aug. 1986.

carefully planned effort to match educational output with economic need and was impressive not only because it was done so efficiently but because it went counter to social demand.

Since the founding of the Republic of China, demand for education has always been very strong. This is reflected not only in the sacrifices children and their families will make to get schooling but also in the expenses they are willing to incur in trying to continue. Many students will spend several years after finishing their schooling in self-study, attempting to pass the high school or university exams, despite income foregone and the expense of tutors and books. Some of this can be attributed to cultural factors - the traditional Chinese respect for learning and scholarship. But much of it can also be attributed to economic reasons. Rates of return calculated in 1972 showed that the private rates for men in senior high over junior high school was 12.7 percentage points.([a]) For university over senior high it was almost 16 percentage points. Other calculations have ranged from 11 to 16 percentage points for university over senior high.([b]) So for any given individual, it was rational to desire more education. While Gannicott found little difference in the rates of return between senior high (12.7) and senior vocational (13.2) over junior high school, demand for senior high school

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[a]. Gannicott, K. Rates of Return to Education in Taiwan, Republic of China, Executive Yuan, Council for International Economic Cooperation and Development, Manpower Development Workgroup, 1973.

[b]. Chang, Ching-Hsi Supply of Education in Taiwan, (in Chinese) Unpublished paper, 1981.

would obviously have been much greater because it was the only route to university. Partly to relieve pressure for more higher education opportunities, the government set up the National Institute of Technology in 1974. It recruited graduates from vocational high schools and junior colleges with two or more years of working experience and awarded its own graduates with an advanced degree.

At the higher education level, the effect of this shift was to keep the numbers of students who entered university at a level below what would have occured if demand had been fully met. Since only senior high graduates had a realistic hope of passing the university exams (anyone was eligible to sit for it), the number of candidates was limited. In fact, from the Fourth MDP (1972) the rate of increase of student enrollments in colleges and universities was stipulated not to exceed 5% a year. In the Fifth MDP (1977) this rate was lowered to 3%. Table 4 shows that the college and university level increases were indeed kept at those levels. For 1970-79 the average annual increase was 5.8% and for 1980-86 it was 3.6%. Table 3 shows that enrollment ratios in higher education have steadily increased, (from 3.2% to 14.1% for men between 1956 and 1985) but they probably have nowhere near met demand. Although there is not a direct measure of demand for higher education, there are some fairly good proxies as shown in Table 6.

The crude entrance ratio is the number of students who enter all kinds of higher education (universities, colleges and 3-year

junior colleges) compared to the number of senior high graduates. It can be assumed that most high school graduates would want to continue to some form of higher education since the curriculum is oriented towards university and college entrance and the vocational students have been selected out. This ratio was 82% in 1986. This seems fairly high, although it has hardly changed since 1954 when it was 75%. But it masks several factors. First, many of those first year entering students sat for the exam many times before succeeding. The ratio of applications to sit for entrance exams to the number of current high school graduates has remained about 1.68 to 1 for many years. There is thus a large group of 'overage' students in each year's entering class. ([10]) If these repeaters are removed, the net entrance ratio for 1986 falls to 48%. Only 48% of current-year graduates can expect to enter higher education the next year.

Also, university exams have a lower pass rate than colleges or junior colleges. The exam pass rate for university was 30% in 1986. This is a lower rate than that of the expansionary 1960's when the rate was as high as 40%, and is thus far below demand, as measured by the number of applicants.

Besides limiting the number of entrants to university and shifting the focus to terminal vocational degrees, the Manpower Development Plans called for a shift in the focus of the

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[10]. Hou, Chi-ming and Ching-hsi Chang, "Education and Economic Growth in Taiwan: The Mechanism of Adjustment" in Conference on Experiences and Lessons of Economic Development in Taiwan, The Institute of Economics, Academia Sinica, Taipei, Taiwan, 1981, p. 481.

curriculum in the universities and colleges. To meet economic growth requirements, emphasis was placed on engineering and natural sciences, rather than on humanities. Consequently, the percentage of students in engineering went from 30% in 1975 to 33% in 1986 and natural science increased from 4.8% to 6.5% in those same years. (See Table 7). Those in humanities were reduced from 10% in 1975 to 7% in 1986 and in fine arts from 3.5% to 2%.

This probably also fits in with a change in demand, since the average salaries for engineers and scientists were usually higher than other graduates. A survey of 1977 university graduates done in 1981 by the National Youth Commission found that there were differences in the average salaries of graduates when differentiated by field. (See Table 8.) Thus medicine, engineering and oceanography graduates earned significantly more than arts or literature graduates. Engineering graduates earned on average NT$16,225 per month while arts graduates earned on average NT$13,286 per month. Medicine, with the highest average earnings of NT$17,790 per month, has also seen a slight proportionate increase in enrollments which the government has encouraged.

Another policy development which resulted from the manpower plans was a decision to expand the role of the private schools. This was perhaps the most crucial step in the expansion of the Taiwanese education system. As Table 9 shows, for the compulsory stage of education, 95-98% of students were enrolled in public

schools. There was a fairly large private sector of up to 18% of enrollment for junior high and junior vocational schools until 1968 when tuition-free and compulsory schooling was extended through junior high. Then the number of public junior high schools was expanded enormously and the private sector dwindled to 4% of enrollment.

At senior high and senior vocational levels and above, the private sector has always been much larger than the private sector at lower levels. However, what is interesting is that it has grown tremendously through the years. In 1950 10% of students at the senior high level and above attended private schools. In 1986 that figure was almost 60%. For junior colleges, the private sector reached almost 80% of students for that level. This has serious implications for the entire school system, particularly for its financing.

Private schools, in general, receive less government funds than public schools and must make up the difference by charging higher tuition and fees. (Public schools also charge tuition and fees at levels above junior high, but lower amounts than private schools.) Table 10 summarizes all the funds that are spent on education, both public and private, from all sources, in the academic year 1985-86. Most students at the lower levels are in the public schools and for senior vocational and higher education, more students are in the private schools. The public expenditure per student is much greater for public schools, except at the primary and snior high level where there must be

some heavily state -subsidized private schools. They account for a very small part ot total enrollment , however. Adding public expenditure per student to private expenditure per student (consisting of average tuition and fees), gives the total expenditure per student for that year. This is an esimate of the unit costs for education. It is apparent that students in private schools below college level have about the same unit costs (or better) that public schools. These private students constitute a coddled elite, being only 9% of total enrollment. However, at junior college and university level, there is a dramatic difference in the unit costs between public and private schools. In 1981, the total annual unit cost including tuition, fees and government subsidies, for public higher education was $83,191. For private higher education it was only $31,805.([11]) This is reflected in sharp quality differences between public and private colleges and universities. Thus private schools have much higher student-teacher ratios. For example, the public university student/teacher ratio is 12:1. For private universities it is 29:1. (See Table 1) The quality gap is particularly apparent in the disciplines with higher unit costs such as natural sciences and engineering which require labs and equipment. One indication of the lower quality of private schools is their graduates poorer performance in the labor market. According to graduate surve

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[11]. Kenneth C.S. Gai, A Survey of Educational Costs, Ministry of Education, 1980 as cited in Charles H.S. Kao, "An Evaluation of ROC's Policy on Tuition for Public Higher Education" in Industry of Free China, May 1984, p.6.

conducted by the National Youth Commission, private university and college graduates were twice as likely than public graduates to be unemployed and took longer to find employment. ([12])

Aside from a difference in total resources available for private vs. public students in higher education, there is also a difference in who bears the cost. Students in public schools pay only about 7% of the total expenditure themselves. In private schools, this figure is close to one-half. (See Table 10.) This has not always been the case.

Table 11 shows the percentage of public funds spent on private students compared to the percentage of students who are enrolled in private schools from 1958 onwards. It reveals that the real discepancy between the percentage of state funds that went to private schools and the percentage of students attending private schools began after 1965. That is when the government began to expand the junior college and college levels a great deal. The total figures in Table 11 show the percentage of private expenditure to total expenditure nearly always exceeded the percentage of private students to total students. But this masks the fact that most of the private enrollment was at the higher and more expensive levels. From 1976 onwards, the more detailed breakdown by level shows that while 50-60% of junior college expenditure was for private schools, they enrolled 76% of all junior college students. At university, the gap was even

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[12]. Current Problems and Policies of College and University Graduate Manpower, National Youth Commission, 1983, (in Chinese), p.81 and p.88.

greater. Private universities received only 27-37% of the total university budget while they enrolled almost 60% of university students.

Since private schools were under government control, this was not a decision to allow schooling to respond more to private or local pressures. It was, in effect, a shift in the burden of costs of education from the public to the individual. Since the expansion of the national education system in 1968, the government was overburdened by the increased costs. Expanding enrollment in private education at the higher levels would allow more student places at a cheaper per student cost for the government than expanding public education.

It has been pointed out by many economists that at the university level particularly, this policy of allowing the growth of high-tuition, private schools is regressive.([13]) Since there is a dramatic difference in quality between the public and private sectors, those who get in to public schools benefit twice -- from a better quality education and a cheaper one. Those who attend universities with their high entrance standards, are more likely to be those from wealthier families who can afford the extra tutors, fees and income foregone which help in passing

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[13]. Hou and Chang, op. cit., Cheng, Peter Wen-Hui Effects of Educational Development on Income Distribution in Taiwan: A Micro-Economic Analysis, Ph.D. Dissertation, University of Minnesota, March 1985, p. 49., and Kao, 1984, op. cit.

exams.([14]) Those who attend the private universities pay about 50% of total educational costs, whereas public university students pay 7% of total costs. Thus, the economists argue, there is a transfer of benefits from tax revenues of the whole population to the elite few who make it into public university. The tuition policy of higher education is not likely to change in the near future for political reasons. The policy represents an important social myth that anyone can make it to the prestigious universities if they are smart enough and that fees will not be a barrier.([15]) This may be efficient in the short-run because it shifts the costs of expansion to the most marginal cadidates. Those who are least capable, as measured by entrance exams, must pay a higher price for their desire to continue their education. However, in the long run it could increase inequality, since the better off, with extra tuition, are more able to pass entrance exams, regardless of their innate ability level.

Another direct link which the MDPs forged between the education system and the economy was the educational expenditure policy. It specifically indexed total expenditure for education to a proportion of the GNP. In the Third MDP, total expenditure for education was to be increased to 6% of GNP by 1980. In the Fourth MDP, it was clarified that the proportion should go up

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[14]. Kao cites a study of the family income of college students in 1979 which shows that the percentage of students from the highest income bracket attending public universities was five times greater than that bracket's representation in the entire population. (Kao, 1984, op.cit.)

[15]. Interview with CEPD official.

from 5.1% in 1971 to 5.4% in 1976.([16]) While the final expenditures did not reach these levels, it did move in that direction (see Table 12), probably as a result of the MDPs. Thus, in 1970 educational expenditure was 4.6% of the GNP; in 1980 it was 4.7% and in 1985 it was 5.5%

Education's share of total government expenditure has also increased. Table 12 shows an increase from 11% in 1955 to 20% in 1970, where it has remained roughly ever since. Compared to other similar countries, Taiwan's educational expenditure is high (see Table 13) and has an especially large share of the total government expenditure. At 5.8% of the GNP, Taiwan's educational expenditure is comparable to other countries at its economic stage or better. Taiwan is also relatively high in its expenditure on education as a proportion of total government expenditure. This indicates that unlike most comparable countries, Taiwan devotes both a large proportion of its wealth and of its public funds to education.

This strong committment, and the resulting high enrollments, has allowed Taiwan to achieve a rising educational level for its labor force (see Table 14). Illiteracy in the labor force has virtually disappeared. The percentage who have graduated from junior college and above has gone from 4% in 1966 to 13% in 1986. Those with senior vocational degrees were 5% in 1966 and are now 18% of the labor force. As Hou indicates, the skills produced by education have contributed to efficiency in the production

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[16]. Hou and Chang, op. cit. p.483.

process and thus made possible such a rapid expansion of Taiwan's labor-intensive export industries.(17)

An important reason for the successful planning of manpower development was Taiwan's highly competitive labor market. Throughout most of its postwar history, Taiwan had few severe manpower imbalances and a low and steadily declining unemployment rate. (The highest recorded level was 2.9% in 1952 and the lowest was 0.7% in both 1979 and 1980. The average rate from 1952 to 1986 was 1.7% (18)) Most studies indicate that wages are competitively determined (there are few labor unions), a high degree of labor mobility, and little market distortion by either the government or foreign firms. (19) This therefore means that wages are a good index of labor productivity and thus labor supply and demand can be more accurately estimated. The manpower requirements approach has major weaknesses, as Hou points out, because it cannot capture shifts in supply, demand or the resultant wage changes.(20) But a competitive labor market will at least ensure a more accurate static measure of these variables.

Thus Taiwan's successful development of human resources

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17. Hou, Chi-ming, 1980, op. cit. p.148.

18. Taiwan Statistical Data Book 1987, Council for Economic Planning and Development, Taipei, Taiwan.

19. Hou, Chi-ming and Hui-lin Wu "Wages and Labor Productivity in Taiwan, Industry of Free China, May and June, 1985.

20. Hou, Chi-ming, 1978, op.cit.

coincided with careful and efficient planning of its education system. While it cannot be proved that the plans caused this success, nonetheless the plans appear to have been implemented to a great degree, and they certainly could not have hindered economic growth. The MDPs have no doubt been the decisive influence in both the slower rate of increase in higher education enrollments and the shift in areas of enrollment at all levels. These changes are summarized in Table 15. By limiting the numbers of students who enter university and by shifting them into vocational streams, the economy was probably able to keep a close match between student's skills and labor market demands. This may also explain why Taiwan did not have a large educated unemployment problem. ([21]) By expanding the elementary level, the education system could meet the needs of the economy for a more literate basic workforce. Since the expansion of higher education was borne in great part by private purses, there was little oversupply of educated manpower, albeit some inequalities. Nevertheless, the education system appears to have been remarkably successful in meeting the needs of Taiwan's economy.

In summary, Taiwan's education system had three features which differentiated its education system from that of other similar developing countries. First, it had an initial infrastructure already built up by 1950 for basic education that

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[21]. Taiwan's unemployment rate for those with a senior high education never exceeded 6.4% between 1967 and 1980 and was on average 4.0% Senior vocational graduates also had an average rate of 4.0% for those years. All other levels were much lower. Figures are from Hou and Chang, op. cit. p. 505.

extended fairly broadly among the population. Second, a ready supply of highly educated manpower arrived in 1949-50 from the Mainland to replace the Japanese and to begin the process of building the local economy. Third, the education system grew steadily but in a manner that closely matched the changing requirements of the growing economy. Particularly after 1966, the supply of educated manpower was geared to meet the economy's needs by national plans. The compulsory basic education was raised from six to nine years, the secondary level curriculum was shifted more towards vocational fields, the supply of university graduates was strictly limited, and its curriculum changed to emphasize science and engineering subjects. The levels above basic junior high level were expanded, but disproportionately into the private sector so they were not as costly.

III. The Shift to a Higher Level of Industrial Technology

Taiwan has now reached an important juncture in its economic development. With the unit cost of labor at 82% of that in the U.S., Taiwan's labor-intensive manufacturing industries are no longer as competitive. In fact, Taiwan has reached a stage of scarcity of unskilled labor. Thus, the economy must continue to shift to more capital-intensive areas -- especially in upgrading the level of industrial technology. The government has chosen to promote certain strategic industries which, besides being non-polluting and energy-conserving, use high-technology. This is in order to restructure Taiwan's economy to more knowledge-intensive areas, since these are seen as having the most potential. If this strategy is to succeed, Taiwan's education system, and especially its production of scientists and engineers must become even more responsive to its economic needs. Currently, only 6% of Taiwan's workforce has at least a university education.([22]) There are major shortages in most scientific and engineering fields. And often the quality of education is less than satisfactory. Thus, from economic necessity, Taiwan must find a way to increase its higher scientific and technical manpower.

Taiwan has explored two options - to create them locally and

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[22]. Directorate-General of Budget, Accounting and Statistics, Yearbook of Labor Statistics, Executive Yuan, Republic of China, 1987, p.23.

to import them from abroad. Each has its advantages and drawbacks but they have both been pursued quite aggressively since 1980. The rest of this paper will examine the nature of Taiwan's strategy in each case and how successful it has been so far in increasing the quantity and quality of highly educated manpower. This manpower is defined as advanced degrees (bachelors, masters or doctorates) in any of the fields of natural science, engineering, medicine, business administration, mathematics and computer science.

A. Local Creation of Scientific and Technical Manpower

Creating the supply of high level manpower locally has several advantages. It increases the liklihood that returns to investments will remain within Taiwan, since local graduates would be less likely to emigrate overseas. It may not be any cheaper from the government's point of view, than sending students abroad, particularly if students win scholarships from overseas or finance their education abroad themselves. However, the money spent locally has lots of positive externalities for the shift to high-tech industries by creating a greater infrastructure for conducting research in high-level science and technical subjects. The greatest disadvantage is that it takes time.

The principal method the government has used, is to increase the enrollments in science and technology subjects in university and to expand the masters and PhD programs for those fields. Table 4 indicates that enrollment in university and graduate

schools has been steadily expanding. Since 1970 the expansion has been quite large, with university and above more than doubling. Taiwan's gross enrollment ratio for higher education was 14.2% in 1984. This is lower than Korea (26.6% in 1984) or Thailand (22.2% in 1982) but is higher than Singapore (11.8% in 1983). Hong Kong (11.8% in 1982) and China (1.3% in 1983).([23]) The average annual rate of increase of graduate school enrollment between 1954 and 1984 is 23.5%. Educational expenditure (see Table 12) has increased both as a percent of GNP and as a percent of total government expenditure since 1980.

There has also been an enrollment shift in the universities from humanities and social science subjects to science subjects, as mentioned above. Table 7 shows that the percentage of students in humanities, fine arts, education and social science have decreased within the past five years. The percentage in natural science and medicine has increased. Engineering enrollments rose enormously in the previous decades but the proportion has not changed much in the recent past. However, compared to many other countries, Taiwan has very high engineering enrollments.

Table 16 shows the percentage of higher education students in science subjects for several countries. Taiwan, along with China, Japan, Korea and Singapore, has the highest percentages in

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[23]. UNESCO Statistical Yearbook, 1985.

engineering, about 18% for BA and 31% for graduate level. (Japan's figures are somewhat bloated because students in architecture, town planning etc. are counted as engineers.) Taiwan is also relatively high in math and computers and business subjects. Medicine is slightly more difficult to assess, since it is a system apart. In the U.S. there are no undergraduate degrees in medicine, in Greece there are no graduate degrees, and in Italy until 1982, the only graduate degrees given out were in medicine. The proportion of students studying medicine in Taiwan appears to be slightly lower than average.

For the future, the government plans to continue to expand university enrollment, particularly in science subjects. It has loosened regulations for setting up universities and colleges and is encouraging their formation - especially engineering and medical schools.

This effort to increase the local supply of higher education has been effective but there are still some major problems. The first is that supply is still not great enough to meet demand. The CEPD did some estimates of the supply and demand for technical manpower. The results, seen in Table 17, show that there are and will be some severe shortages, particularly in engineering, business subjects, and medicine, provided the economic forecasts are correct.

The second major problem with expanding the supply locally is that the quality of graduates is uneven. There are disparities between public and private schools, as mentioned earlier, due to

discrepancies in the per student expenditure for each type of school. There are also differences in quality among public schools, as revealed in university entrance exam results. There are some public senior high schools that have not had a single graduate get into university.([24]) Overall however, it is difficult to estimate how well Taiwan's graduates do in an international context. While their high school achievement in math and language is known to be quite high, little is known about how well their university graduates and post-graduates compete on an international scale.([25]) They have a reputation for being quite competent in mathematics, science and engineering subjects. However, since Taiwan's school system and culture is similar to Japan's, they may also share one disadvantage with the Japanese. That is, in general, a tendency not to engage in creative and unconventional kinds of thinking, or to question established routines. As Stevenson et al. argues, this is probably an advantage at the lower kinds of intellectual learning which is done in high school and college, where accepted theories of knowledge are simply learned and applied. But at the frontiers of knowledge, where technological breakthroughs are made, this sort of thought process and the social relations which reinforce it, may become an inhibition to devising new approaches

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[24]. Interview with Council for Economic Planning and Development official.

[25]. Stevenson, Harold; James Stigler, Shin-ying Lee, and G. William Lucker, 'Cognitive Performance and Academic Achievement of Japanese, Chinese and American Children', Child Development, Vol. 56, June 1985, pp. 718-734.

to problems in order to solve them. This being said, it must also be added that the number of minds needed to be truly creative in order to invent technological breakthroughs are very small compared to the vast majority who must simply learn to follow orders. Also, as Japan has shown, adopting others ideas to one's own context, while not brilliant on a world scale, is enough to allow the country to advance a long way. Finally, Taiwan has produced some world-class creative geniuses - although many of them did not do their work in Taiwan. There are several Nobel Prize winners who originated from Taiwan. And, as is explained in the next section, Taiwan has nevertheless been able to tap some of this brilliance.

Research and Development Expenditure

Taiwan has increased its investments in research and development in recent years. In 1985 the figure was NT$25 billion (US $627 million) excluding R&D expenditure for national defense.[26] This was about 1.06% of GNP, somewhat less than Japan, U.S., or Western Europe (2.3 - 2.7%) but equivalent to Korea (1.04%).[27]

Although 60% of Taiwan's expenditure is in industry and only 40% in research institutes and universities, most of the source of funds is from government. In 1983, 60% of national R&D expenditure was from government and 40% was from private industry

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26. Taiwan Statistical Data Book, 1987.

27. UNESCO Statistical Yearbook, 1985.

and non-profit organizations.([28]) Most of the R&D funded by industry is done by large firms in-house, or by large trade associations. It appears that small, high-tech firms are not investing in R&D. One indication may be the ratio of male salaried workers to total employees on the payrolls of electronic products manufacturing. This industry was chosen as most likely to engage in high-technology, computer-related activities. Table 18 shows that salaried men made up only 14.6% of total wage earners in 1986. Since very few women study engineering or science (8% at the BA level for engineering and 24% for science in Table 19), this can be a proxy for the ratio of highly educated research or administrative personnel to blue collar workers. Since the ratio is so small and has changed only imperceptibly in the last decade, one can probably conclude that on the whole, most firms are engaged in low wage manufacturing and not in high-level technical research.

B. Importation from Abroad of Scientific and Technical Manpower

Taiwan has always been a net exporter of human capital. For twenty years before 1970, no more than 13% of those who left in any given year, returned to Taiwan (see Table 20). Until 1965, all graduates had to pass an exam before going abroad. Thus only the best and brightest went abroad . In 1986, the number of students abroad was 7,016. Of those, 93% went to the U.S. Since these are virtually all graduate students (until now only those

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[28]. Council for Economic Planning and Development, Ninth Medium-Term Economic Development Plan for Taiwan, ROC (1986-1989), Executive Yuan, Dec. 1985, p. 292.

with local undergraduate degrees were allowed to study abroad) it constitutes more than three times the number of local graduate students which was only 2,143 in 1986.

Of those in the U.S., one third went into engineering, 20% into business adminstration and the rest in other subjects - humanities, natural science, social science, math and computers (see Table 21). This is roughly the same distribution as in higher education in Taiwan. In other foreign countries, Taiwanese are more likely to be in humanities, studying the local language and culture. However, in 1986 there were only 517 students abroad in a country other than the U.S., and mostly in Japan.

Unlike most countries that see this as an irretrievable loss, a 'brain drain', Taiwan has decided to tap this pool as an important source for its future. This attitude stems from both a practical consideration that Taiwan needs exactly these sorts of bright and educated minds to lead its economic progress and from a cultural consideration. Taiwan perceives these people, as well as all Chinese, to be members of its society. Since it casts itself as the real homeland for all Chinese and the preserver of a unique and homogeneous cultural heritage, it is only natural that it should actively encourage as many Chinese as possible to return. It should be added that passively, Taiwan has been recruiting returnees for many years.

The first step in actively recruiting Chinese scholars and students back to Taiwan was to investigate why so many had left,

and therefore what might entice them back. In 1980, and for several years after, the National Youth Commission sponsored several studies of Taiwanese students planning to go abroad, those who were abroad studying or working in the U. S., and American-educated scholars who had returned to Taiwan.

In a 1981 study, university graduates were surveyed on why they were going to study abroad.([29]) Their reasons, in order of importance, were to seek a higher degree, to experience a better research environment abroad, the lack of a suitable job domestically and the better work opportunities abroad. This study also asked 804 students who were overseas why they wanted to return home. They cited age, marital status, contract obligations, current salary and domestic manpower needs as reasons they would serve their country.

A more recent study surveyed 5,075 scholars and students from Taiwan who did not return after studying abroad. The most common reason for not returning was that Taiwan had no appropriate working opportunity. Other important reasons were: a better working environment abroad, better pay abroad, and disappointment with the domestic social system.([30])

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[29]. "Research on the Education of Those Who Studied Abroad in the Last Twenty Years", Youth Manpower Research Report No. 17 (in Chinese), Executive Yuan, National Youth Commission, Taiwan, 1981.

[30]. "Research Analysis on Students Studying Abroad and Their Service to the Nation", Youth Manpower Research Report No. 36 (in Chinese), Executive Yuan, National Youth Commission, Taiwan, 1984.

One of the earliest surveys on this subject was Kao's study of Chinese students and scholars in the U.S. and a group of them who had returned to Taiwan.([31]) The survey is now somewhat out of date but is probably still applicable. Kao interviewed 372 scholars, 155 from Mainland China and 217 from Taiwan. He found that the factors cited most often as attracting Chinese graduates to stay in the U.S., in order of importance, were better teaching and research facilities, higher salaries, political freedom, better intellectual atmosphere, and academic freedom. It is these differences which Taiwan must address, if it is to attract back more Chinese students who study abroad.

Kao surveyed 127 Chinese students who had returned to Taiwan from the U.S. The reasons cited for returning were to contribute to society, be reunited with their families, fulfill contract obligations (usually to the Taiwan government) and avoid a difficult U.S. visa status. The last two are obviously not voluntary reasons. Two-thirds of the returning sample were in humanities and social science, particularly journalism, law, literature and political science. These fields are better practiced in one's indigenous country and it is thus more likely that these students would return home. One-third of the returnees were not satisfied with their present jobs and the reasons they cited were income, research facilities, professional acknowledgement, and career advancement.

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[31]. Kao, Charles H.C. Brain Drain: A Case Study of China, Mei Ya Pub., Taipei, R.O.C., 1971.

Kao's findings were confirmed by two more recent surveys sponsored by the National Youth Commission of students who had returned to Taiwan. In 1980, a study found eight factors that affected satisfaction toward work for 1,984 students who had returned from abroad.([32]) They were, in order from most satisfactory to least satisfactory : interpersonal relationships on the job, evaluation by employer, career achievement, salary and benefits, equipment and facilities, personnel management, on-the-job training, and promotion.

A 1983 survey of 4,434 returning students found their motives for returning were to serve their country in a significant way, fulfill expectations of parents and family and obtain suitable working opportunities in Taiwan.([33]) This survey found that the job satisfaction of those who returned to Taiwan was lower than while working abroad but that it tended to rise the longer they stayed in Taiwan. This probably reflects the high psychological costs of relocating or the tendency to accept one's lot in life after a period.

In summary, what entices students abroad into staying abroad (mostly the U.S.) and working there are the working opportunities, with their high salaries, better facilities, freer

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[32]. "Research on Students Studying Abroad and Returning and Their Service to the Nation", Youth Manpower Research Report No. 12 (in Chinese), Executive Yuan, National Youth Commission, Taiwan, 1980.

[33]. "Research Analysis on Students Studying Abroad and Their Service to the Nation", Youth Manpower Research Report No. 36 (in Chinese), op.cit.

collegial atmosphere, and opportunities for promotion and recognition. What draws students back, in much fewer numbers, are a desire to serve their country, to be reunited with their families, and to meet contractual obligations. If Taiwan is to attract graduates back to their homeland, they must offer better working conditions and higher salaries.

In fact, Taiwan has taken several practical steps to recruit graduates back from abroad. The first is to increase the resources and publicity of the National Youth Commission. It provides services to Taiwan graduates abroad who want to return home to work. Overseas students who are under 50 years of age, hold a BA from Taiwan and MA or PhD degrees from foreign universities and who want to return to Taiwan for at least one year can get assistance in moving and employment from the National Youth Commission. They and their families may get reimbursed for all travel and moving expenses back to Taiwan. Their names and resumes are forwarded to more than 2,500 private and public institutions for employment. They also receive subsidies for dependents' medical care and education, year-end bonuses, and employee insurance for an initial time period. In 1986, 8,701 students were registered with this service and 18% of them found jobs through it. ([34])

Examining more recent return rates for students from abroad indicates that more students are being attracted back. Table 20

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[34]. National Youth Commission, Youth Employment Statistical Bulletin, (in Chinese) Executive Yuan, May, 1987.

reveals that in 1980 the rate had risen almost double that of 1955, from 4.5% to 10.8%. In 1984, almost one quarter of students abroad returned home. However, it is difficult to tell the causes. Some could be due to specific government policies such as the services of the National Youth Commission. There are other more fundamental possible reasons.

One theory is that there has been a general structural change in the Taiwanese economy which has caused it to be able to absorb more highly-educated personnel. As Galenson points out, where an economy has a growing segment of labor-intensive processing industries, there may be a declining ratio of professional and managerial personnel.([35]) However, while the ratio may have been declining, the absolute number of positions for engineers and scientists was expanding as these industries grew. The local supply of graduates, on the contrary, was not. The government kept tight control of engineering and science fields and even the first MDP in 1966 called for increasing the proportion of enrollments in science and engineering in higher education.([36]) Government manpower surveys show shortages for most fields of science and engineering abov a bachelor's degree for the last fifteen years. Thus Taiwan's economy probably always could have absorbed these students had they chosen to return. It is more

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[35]. Galenson, Walter "The Labor Force, Wages and Living Standards" in Walter Galenson, ed., Economic Growth and Structural Change in Taiwan, Cornell University Press, Ithaca, N.Y., 1979, p.397.

[36]. Hou and Chang, op.cit., p.483.

probable that the recently improved return rate reflects Taiwan's better ability to compete with the U.S. to attract educated manpower. Taiwan's general level of development is higher now, it has a better infrastructure, more and better quality facilities, and a somewhat more open political and social atmosphere. Also, the U.S. has experienced an economic downturn, especially in high-tech industries which would reduce the number of attractive jobs available. Finally, new immigration laws since 1986 may have had an effect as well.

In March 1983, the Executive Branch of the Taiwan government promulgated the "National Plan for Strengthening the Education, Training and Recruitment of High-Level Science and Technical Personnel". This signalled the beginning of a more aggressive recruitment of overseas personnel (as well as the continued expansion of local supply). It addressed the principal policy options that the government could take to recruit overseas. It also outlined the government's decision to recruit those who had work experience overseas in strategic industries that the government was anxious to expand. This plan led to several changes.

First, the government would recruit actively. Instead of merely responding to requests for help in returning to Taiwan, the government's representatives would seek out likely cadidates and try to pursuade them to return. Second, there would be a concerted effort to improve working conditions for those who returned. Salary and benefits comparative to the U.S. would be

offered, at least for an initial period, and various exemptions from local examinations would be allowed for government servants. Short-term as well as long-term employment was encouraged. In short, hiring regulations would be more flexible in order to attract experienced people from abroad. Much of this new activity was taken on by the National Science Council.

One of the most active parts of this effort has been the promotion of the Hsin-Chu Industrial Park.([37]) It was established as a centerpiece in the push for knowledge-intensive industries and played a special part in recruiting talent back from overseas. U.S. scholars and entrepreneurs of Taiwanese origin were persuaded to return to Taiwan and start their own companies. Legislation setting up this park encouraged investment in certain chosen industries by reducing the risk that investors must bear. Investors are allowed five years of tax exemption, a 22% ceiling on corporate income tax and reduction in land rent. Other exemptions are offered for various import and export fees. Low-cost loans of up to 49% of the total investment and other sources of capital are available without encroaching on private control.([38]) The Park itself offers quality housing, a special bilingual school, and promises of improvements in transportation and infrastructure.

The Taiwan government recruits actively for the Hsin-Chu

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[37]. See Wu, Yuan-li Becoming an Industrialized Nation, Praeger Pub., New York, 1985, Chapter 3.

[38]. Johnstone, Bob, "Diverting the Brain Drain", Far Eastern Economic Review, Jan. 28, 1988, p.70.

Industrial Park and specifically among overseas Chinese in the U.S. The Office for International Cooperation, part of the National Science Council, has offices in Los Angeles, Washington D.C., Houston and Mountain View, California. The last office is in the Silicon Valley, specifically to recruit for the Hsin-Chu Park. The office screened small and medium enterprises in the target industries to compile a list of 10,000 Chinese employees who might be interested in Hsin-Chu and whose skills and talents were attractive to Taiwan. The office then contacted every employee on the list and explained the objective of the Science Park to them with all its inducements to return. The office continues to keep in contact with potential recruits and regularly remind them of opportunities for work back in Taiwan. If an entrepeneur is interested, the Park administration will evaluate his management experience, the market for the product, and decide whether the venture is appropriate. Finally, the office will help make financing arrangments.

So far, after collecting names for four months, the Silicon Valley office has received over 2,000 questionnaires filled out by prospective applicants. Recruiting appears most successful with two groups of engineers. One is those who are under 30, who have not yet established themselves in the U.S. and who face the new, harsher immigration laws. The other group is those over 45 who are earning high salaries but who see their prospects for promotion as limited. They are attracted to starting their own company and having a greater position of responsiblity.

To date, the Hsin-Chu Industrial Park has 73 companies, 30 of which are new and the rest are branches of established firms. Seventy percent of the companies are under the direction of Chinese who have been recruited back from the U.S.([39]) Out of the 73 companies, only two have not thrived since the Park was founded.([40])

There is another way to tap the talents of Taiwanese or other Chinese who have emigrated to the West. If they are reluctant to leave their U.S. careers and bring their families to Taiwan permanently, they can often be enticed into coming for a short period instead. While it may be somewhat expensive, since fixed costs in the U.S. must still be met, it is worth it because the adjustment cost is very low. Compared to other imported talent, there are few or no language and cultural barriers with Taiwanese who have emigrated, and presumably they have a sense of patriotism or cultural loyalty which can be appealled to. Many universities in Taiwan have American-educated Chinese as visiting professors. Figures are hard to obtain, however many research institutes or their departments and government advisory bodies are directed by visiting scholars who 'commute' from permanent teaching posts in the United States. The National Science Council recruited some 3,200 persons between 1970-1980, mostly

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[39]. Viviano, Frank "Transplanting the Silicon Valley" The San Francisco Chronicle, June 21, 1987.

[40]. interview with Hsin-Chu Park Administration official

for short-term assignments in Taiwan.(*1) There are also non-Chinese foreigners working in Taiwan. Some Americans have set up industries at the Hsin-Chu Industrial Park. Other foreigners are scholars, teachers or entrepreneurs elsewhere. While figures are not available, it is probably correct to assume that foreign technical experts are not numerous and they don't presently constitute a significant source for future technological progress.

IV. Conclusion

It is clear that Taiwan has taken its future needs for highly-trained technical manpower seriously and is devoting significant effort to solving them. Aside from educational expansion, however, Taiwan has chosen a more unorthodox short-term method to solve its manpower needs. Taiwan recruits them back from overseas. And it appears, at least from an early stage, to be succeeding. They have lured at least 50 entrepeneurs and probably many times that number, to return from lucrative high-tech careers in the U.S. to help remake Taiwanese industry. Taiwan has not only actively recruited these experts, but they have, after much research, specifically chosen the particular talent they want. Thus they have been able to dictate, according to their own terms, the kind of industries that will become Taiwan's future. As the successful growth of the education system has shown, careful planning tied to

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*1. Wu, Yuan-li, op. cit.

recurrent monitoring of economic conditions can greatly enhance the links between human resource development and the economy. However, expanding a basic education system is a somewhat easier job, especially for a structuralist planner working with growth projections and an input-output table. It is somewhat more difficult to make that system to regularly produce and nurture enough talent to create technological breakthroughs which will restructure Taiwanese industry. It is a question which most advanced nations are struggling with as well -- how to maintain quality and foster genius.

Table 1: Summary of Schools, Teachers, and Students by Levels, Public and Private, FY 1986-87

	No. of Schools	No. of Teachers	No. of Students	Student/Teac
Elementary Schools				
Public	2,464	74,023	2,339,469	31.6
Private	22	815	24,969	30.6
Total	2,486	74,838	2,364,438	31.6
Junior High Schools				
Public	667	46,516	1,007,660	21.7
Private	*	*	*	*
Total	676	46,793	1,052,993	22.5
Senior High Schools				
Public	80	8,578	150,423	17.5
Private	95	5,757	50,176	8.7
Total	175	14,335	200,599	14.0
Senior Voc. Schools				
Public	89	9,698	169,745	17.5
Private	115	7,023	268,179	38.2
Total	204	16,721	437,924	26.2
Junior Colleges				
Public	21	3,530	53,536	15.2
Private	56	6,914	190,946	27.6
Total	77	10,444	244,482	23.4
Colleges				
Public	6	1,051	12,899	12.3
Private	6	1,188	18,700	15.7
Total	12	2,239	31,599	14.1
University				
Public	9	5,642	66,377	11.8
Private	7	3,444	100,190	29.1
Total	16	9,086	166,567	18.3
Grand Total				
Public	3,336	149,038	3,800,109	25.5
Private	310	25,418	698,493	27.5
Total	3,646	174,456	4,498,602	25.8

*Note: The MOE states that there are 9 junior high schools with 277 teachers and 45,333 students. This number is impossibly low, probably because junior high schools attached to senior high schools have not been counted.

Source: Ministry of Education, EDUCATIONAL STATISTICS OF THE REPUBLIC OF CHINA, 1987.

Table 2: Total Educational Budget for Public and Private Schools by Level FY1985 - 86
and Percent Private Enrollment
Unit: NT$1,000

	Total	Public	Private	Private budget as a Percent of Total for that level	Private students as Percent of Total for that level
Elementary Schools	31,004,799	30,616,558	388,241	1.3%	1.1%
Junior High Schools	21,695,522	21,529,198	166,324	0.8%	4.2%
Senior High Schools	9,468,731	5,695,499	3,773,232	39.8%	24.3%
Senior Voc. Schools	12,073,361	7,132,949	4,940,412	40.9%	60.5%
Junior Colleges	10,932,201	4,662,550	6,269,651	57.4%	76.5%
Univ. and Colleges	18,727,605	13,786,686	4,940,919	26.4%	59.8%
Total	103,902,219	83,423,440	20,478,779	19.7%	15.1%

Source: Ministry of Education, EDUCATIONAL STATISTICS OF THE REPUBLIC OF CHINA, 1987, p.43.

Table 3: Gross Enrollment Ratios, 1956 - 1985

%

Year	Primary Level 6-11 years	Secondary Level 12-17 years		University and College 18-24 years	
		Male	Female	Male	Female
1956	93.8	28.3	12.9	3.2	0.5
1958	94.8	33.9	16.6	4.0	0.9
1960	95.6	39.1	21.3	4.9	1.3
1962	96.5	43.4	26.1	6.1	1.7
1964	96.8	44.5	28.1	8.4	2.6
1966	97.2	46.6	30.2	11.0	4.4
1968	97.7	53.9	36.1	11.0	5.9
1970	98.0	63.5	44.7	10.2	6.4
1972	98.1	71.0	52.0	11.1	7.0
1974	98.5	69.8	56.8	11.8	7.1
1976	99.4	78.3	69.9	11.6	7.1
1978	99.6	78.7	73.8	11.9	8.5
1980	99.7	80.9	79.8	11.9	9.1
1982	99.8	85.2	85.7	12.5	10.2
1984	99.8	88.0	89.7	13.4	11.5
1985	99.9	89.0	92.0	14.1	12.0

Note: Gross enrollment ratio = $\frac{\text{Enrollment at that level}}{\text{Population of that age-group}}$

Source: STATISTICAL YEARBOOK OF THE REPUBLIC OF CHINA, 1986,
Directorate-General of Budget, Accounting and Ststistics, Executive Yuan, p.247.

Table 4: Enrollments and Average Annual Increase in Enrollment, 1950 - 1986

Enrollments Unit: person

Academic Year	Total	Primary	Junior High (& Jr Voc & Normal bef'73)	Senior High	Senior Voc. (and Normal, '73 and after)	Jr. College	College & Univ. and above
1950	1,033,651	906,950	89,944	18,866	11,226	1,286	5,379
1955	1,475,624	1,244,029	162,235	30,169	21,186	4,545	13,460
1960	2,279,117	1,888,783	253,145	57,512	44,617	7,838	27,172
1965	3,006,828	2,257,720	473,442	116,197	74,114	29,543	55,812
1968	3,465,707	2,383,204	652,083	152,877	116,206	79,456	81,881
1969	3,641,008	2,428,041	729,651	161,459	137,642	95,988	88,227
1970	3,903,467	2,445,405	800,402	178,537	175,650	108,328	95,145
1972	4,034,054	2,459,743	909,197	197,151	216,905	138,310	112,748
1975	4,160,389	2,364,961	1,036,357	185,181	284,455	150,226	139,209
1980	4,181,801	2,233,706	1,075,532	180,665	349,370	183,134	159,394
1982	4,266,038	2,226,699	1,082,358	187,015	394,270	203,722	171,974
1985	4,429,043	2,321,700	1,062,226	194,757	421,784	236,824	191,752
1986	4,498,602	2,364,438	1,052,993	200,599	437,924	244,482	198,166

Average Annual Increase Unit: percentage

								5-9 yr. pcp.
1953 - 1959	9.1%	8.5%	11.5%	14.7%	16.2%	9.2%	20.4%	8.5%
1960 - 1969	5.5%	3.2%	12.7%	11.6%	13.1%	33.9%	13.9%	1.8%
1970 - 1979	1.4%	-0.7%	4.1%	1.3%	9.3%	6.3%	5.8%	-1.0%
1980 - 1986	1.1%	0.7%	-0.4%	1.5%	4.2%	4.9%	3.6%	1.4%
1953 - 1986	4.1%	2.6%	7.2%	7.1%	10.8%	14.7%	10.7%	2.3%

Sources: Ministry of Education, EDUCATIONAL STATISTICS OF THE REPUBLIC OF CHINA, 1987, p.18 and Council for Economic Planning and Development, TAIWAN STATISTICAL DATA BOOK, 1987, p.9 & 29.

Table 5: Enrollment Ratios Between Academic and Vocational Stream at Senior High Level
1950 - 1986

Year	Senior High Total Enrollment	Academic Enrollment	Vocational Enrollment	Voc as a % of Total Sr. Hi
1950	30,092	18,866	11,226	37.3%
1955	51,355	30,169	21,186	41.3%
1960	102,129	57,512	44,617	43.7%
1963	137,314	82,893	54,421	39.6%
1965	190,311	116,197	74,114	38.9%
1970	354,187	178,537	175,650	49.6%
1972	414,056	197,151	216,905	52.4%
1975	469,636	185,181	284,455	60.6%
1980	530,035	180,665	349,370	65.9%
1986	638,523	200,599	437,924	68.6%

Source: Ministry of Education, EDUCATIONAL STATISTICS OF THE REPUBLIC OF CHINA, 1987, p.18

Table 6: Acceptance Ratio for Higher Education, 1954 - 1986

%

Year	Crude Entrance Ratio*	Net Entrance Ratio**	University Exam-Passing Ratio***
1954	75.17	...	20.27
1956	76.17	...	30.83
1958	66.22	...	35.09
1960	76.37	...	35.38
1962	72.74	...	38.48
1964	77.51	...	40.29
1966	68.11	...	38.54
1968	71.19	...	35.96
1970	71.93	41.92	34.60
1972	83.43	42.62	26.95
1974	73.41	39.68	26.83
1976	77.05	42.39	27.63
1978	74.27	40.42	28.30
1980	79.90	44.64	29.25
1982	81.00	46.03	31.22
1984	82.15	44.36	32.10
1986	82.22	48.19	30.66

*1. Crude Entrance Ratio = $\frac{\text{No. of 1st grade students in universities, colleges, \& 3-year junior colleges}}{\text{No. of senior high school graduates}} \times 100\%$

**2. Net Entrance Ratio = $\frac{\text{No. of current-year graduates entering the 1st grade of universities, colleges, \& 3-year jr. colleges}}{\text{No. of senior high school graduates}} \times 100\%$

***3. Exam-Passing Ratio = $\frac{\text{No. of students who passed entrance exams}}{\text{No. of applications to take exams}} \times 100\%$

Source: Ministry of Education, EDUCATIONAL STATISTICS OF THE REPUBLIC OF CHINA, 1987, p.32,34.

Table 7: Distribution of Students Receiving Higher Education by Discipline - Selected Years

Year	Total (Persons)	Humanities	Education	Agriculture	Law	Social Science & Behavior	Natural Sciences	Engineering	Medical Science	Fine Arts	Other
					(Percentage)						
1952-53	10,037	19.1	4.8	12.3	3.7	19.3	6.9	25.8	3.2	2.9	2.0
1955-56	18,174	13.6	5.8	11.2	6.8	23.3	6.2	24.6	3.9	2.2	2.4
1960-61	35,060	18.1	4.7	8.7	3.3	25.2	9.2	19.9	7.8	2.8	0.3
1965-66	85,346	12.2	7.6	6.4	1.9	38.4	6.5	15.1	8.4	3.1	0.5
1970-71	203,473	9.5	6.8	5.6	1.4	34.1	5.1	24.5	10.2	2.7	0.0
1975-76	289,435	10.0	7.3	3.6	1.3	31.8	4.8	30.3	7.4	3.5	0.0
1980-81	342,529	8.4	6.0	3.5	1.3	31.8	4.5	33.6	7.8	3.1	0.0
1982-83	375,696	7.6	5.7	2.7	1.3	32.4	5.9	34.3	7.8	2.4	0.0
1985-86	428,576	7.1	5.6	3.1	1.2	26.0	6.3	32.8	8.3	2.0	7.7
1986-87	442,648	7.0	4.8	3.2	1.2	26.1	6.5	32.9	8.5	2.0	7.7

Source: Taiwan Statistical Data Book, Council for Economic Planning and Development, R.O.C., 1987, p.287.

Note: Since the 1983-84 school year, curricula in Taiwan's institutions of higher learning have been organized according to UNESCO standards. Thus the categories in this table after 1983 don't exactly match those of the previous years.

Table 8: Monthly Salary Range of University Graduates by Field, 1981
Unit = persons (salary is in NT$ per month)

Field	6,000 or less	6,001 ~ 8,000	8,001 ~ 10,000	10,001 ~ 12,000	12,001 ~ 14,000	14,001 ~ 16,000	16,001 ~ 18,000	18,001 ~ 20,000	20,001 ~ 22,000	22,001 or more	Total	Average	Standard Deviation
Literature	0	6	22	72	65	38	21	16	7	9	257	13,521	3,528
Natural Science	0	4	7	32	39	26	25	15	6	1	155	14,187	3,305
Law	1	4	9	24	43	27	18	15	3	13	157	14,618	3,962
Business	0	3	8	30	28	23	29	17	17	11	166	15,410	4,069
Medicine	0	0	1	7	13	10	8	12	9	21	81	17,790	4,247
Engineering	1	2	8	28	55	67	96	56	24	22	359	16,225	3,419
Agriculture	2	0	5	16	14	8	6	7	2	3	63	13,952	4,029
Management	0	0	3	15	24	26	22	20	5	10	125	15,864	3,554
Oceanography	0	1	1	12	6	3	6	8	1	9	47	16,021	4,683
Education	0	0	1	15	14	11	7	0	0	2	50	13,720	2,850
Arts	0	0	0	6	2	5	0	1	0	0	14	13,286	2,373
Total	4	20	65	257	304	244	238	167	74	101	1,474		

Source: Kao, Charles, H.C., Kuang Lu, and Che Sheng Kai,
CURRENT PROBLEMS AND POLICIES OF COLLEGE AND UNIVERSITY
GRADUATE MANPOWER, (in Chinese) National Youth Commission, 1983, p. 148.

Table 9: Private Enrollment in Education by Level, 1950 - 1986

Academic Year		Total	Primary	Junior High (and Jr Voc and Normal bef. '73)	Senior High	Senior Voc. (and Normal, '73 and after)	Junior College	College & Univ. and above
1950	Total	1,003,651	906,950	89,944	18,866	11,226	1,286	5,379
	Private	11,560	0	7,823	2,502	861	374	0
	% Private	1.1%	0.0%	8.7%	13.3%	7.7%	29.1%	0.0%
1955	Total	1,475,624	1,244,029	162,235	30,169	21,186	4,545	13,460
	Private	23,886	0	14,050	4,624	2,765	992	1,455
	% Private	1.6%	0.0%	8.7%	15.3%	13.1%	21.8%	10.8%
1960	Total	2,279,117	1,888,783	253,145	57,512	44,617	7,888	27,172
	Private	97,750	36,386	31,050	10,289	10,584	2,854	6,607
	% Private	4.3%	1.9%	12.3%	17.9%	23.7%	36.2%	24.3%
1965	Total	3,006,828	2,257,720	473,442	116,197	74,114	29,543	55,812
	Private	216,455	40,559	86,228	23,442	23,208	18,022	24,997
	% Private	7.2%	1.8%	18.2%	20.2%	31.3%	61.0%	44.8%
1970	Total	3,803,467	2,445,405	800,402	178,537	175,650	108,328	95,145
	Private	320,514	22,955	35,590	43,876	89,154	79,882	49,057
	% Private	8.4%	0.9%	4.4%	24.6%	50.8%	73.7%	51.6%
1975	Total	4,160,389	2,384,961	1,036,357	185,181	284,455	150,226	139,209
	Private	462,701	27,425	42,957	38,507	163,372	110,527	79,913
	% Private	11.1%	1.2%	4.1%	20.8%	57.4%	73.6%	57.4%
1980	Total	4,181,891	2,232,706	1,075,532	180,665	249,370	182,134	159,334
	Private	550,461	25,523	47,363	39,008	205,634	140,292	92,941
	% Private	13.2%	1.1%	4.4%	21.6%	58.9%	76.6%	58.3%
1985	Total	4,429,043	2,321,700	1,062,226	194,757	421,784	236,324	191,752
	Private	667,826	24,781	44,527	47,340	255,299	181,178	114,702
	% Private	15.1%	1.1%	4.2%	24.3%	60.5%	76.5%	59.9%
1986	Total	4,498,602	2,364,479	1,052,993	200,599	437,924	244,482	198,166
	Private	698,493	24,969	45,333	50,176	268,179	190,946	118,890
	% Private	15.5%	1.1%	4.3%	25.0%	61.2%	78.1%	60.0%

Source: Ministry of Education, EDUCATIONAL STATISTICS OF THE REPUBLIC OF CHINA, 1987, p. 18.

Table 10: Expenditure per Student by Public and Private Education, 1985-84

Unit = NT$1,000 or persons

	Primary	Junior High	Senior High	Senior Vocational	Junior College	University & College
Total Public Expenditure*						
Public	30,616,558	21,529,198	5,695,499	7,132,949	4,662,550	13,786,686
Private	388,241	166,324	3,773,232	4,940,412	6,269,651	4,940,919
Enrollment						
Public	2,296,919	1,017,699	147,417	166,486	55,646	77,050
Private	24,781	44,527	47,340	255,298	181,178	114,702
Total Public Expenditure per student						
Public	13.33	21.15	38.64	42.84	83.79	178.93
Private	15.67	3.74	79.70	19.35	34.60	43.08
Total Private Expenditure per student**						
Public	0.00	1.50	3.63	3.41	11.41	14.63
Private	10.80	13.11	16.95	17.15	30.73	42.95
Total Expenditure per student***						
Public	13.33	22.65	42.27	46.25	95.20	193.56
Private	26.47	16.85	96.65	36.50	65.34	86.02
Percent Total Expenditure from Private Sources						
Public	0.0%	6.6%	8.6%	7.4%	12.0%	7.6%
Private	40.8%	77.8%	17.5%	47.0%	47.0%	49.9%

Source: Ministry of Education and MOE, EDUCATIONAL STATISTICS OF THE REPUBLIC OF CHINA, 1987, p. 18, 38.

Notes:

*1. includes central, provincial, municipal, country, city, village, and and town expenditures

**2. average tuition and fees (they vary by school and subject matter)

***3. public expenditure per student plus tuition and fees

Table 11: Percent State Expenditures on Private Schools and Enrollment of Private Students, 1958 - 1986
(Unit: percent of total)

Academic Year	Total		Elementary		High		Junior College		Higher Education		College & Universit	
	Exp.	Students	Exp.	Students	Exp.	Students	Exp.	Students	Exp.	Students	Exp.	Students
1958	8.4%	2.1%	0.0%	0.0%	13.8%	12.2%			19.4%	22.4%		
1959	9.2%	4.1%	0.0%	2.0%	15.8%	14.0%			21.0%	23.4%		
1960	13.2%	4.3%	2.7%	1.9%	19.5%	14.6%			28.6%	27.0%		
1961	12.2%	4.6%	2.1%	1.9%	19.0%	15.4%			24.3%	27.9%		
1962	13.8%	5.0%	2.0%	1.9%	21.0%	16.4%			32.3%	30.4%		
1963	14.9%	5.6%	2.0%	1.9%	22.8%	17.8%			32.4%	35.2%		
1964	19.7%	6.4%	2.1%	1.9%	24.7%	19.1%			45.6%	42.0%		
1965	19.5%	7.2%	2.4%	1.8%	20.9%	20.0%			45.5%	50.4%		
1966	19.6%	7.9%	2.0%	1.5%	22.0%	20.6%			44.5%	57.2%		
1967	20.4%	8.4%	1.3%	1.0%	22.2%	21.4%			44.6%	59.6%		
1968	18.1%	8.0%	2.2%	0.8%	15.3%	17.3%			41.9%	61.4%		
1969	16.9%	8.1%	0.9%	0.8%	13.8%	15.5%			39.3%	62.6%		
1970	19.9%	8.4%	4.3%	0.9%	18.0%	14.6%			36.9%	63.4%		
1971	23.5%	9.0%	3.2%	1.0%	22.7%	15.2%			50.5%	63.2%		
1972	22.2%	9.6%	3.1%	1.1%	20.7%	15.4%			49.6%	62.2%		
1973	18.5%	10.1%	2.1%	1.1%	14.7%	15.5%			49.2%	63.7%		
1974	21.6%	10.6%	1.9%	1.1%	20.7%	15.8%			51.9%	64.8%		
1975	18.4%	11.1%	1.9%	1.2%	18.8%	16.3%			40.3%	65.8%		
1976	16.9%	11.5%	1.4%	1.1%	19.8%	16.3%	73.8%	75.2%			31.9%	59.6%
1977	18.7%	11.7%	1.3%	1.1%	23.2%	16.4%	63.4%	75.9%			35.9%	57.7%
1978	17.3%	12.6%	1.3%	1.1%	21.6%	16.6%	58.7%	76.3%			33.4%	57.8%
1979	16.7%	12.6%	1.3%	1.1%	21.0%	17.4%	62.1%	76.9%			25.7%	58.2%
1980	18.6%	13.2%	1.4%	1.1%	22.1%	18.2%	57.2%	76.6%			31.2%	58.3%
1981	18.5%	13.8%	1.4%	1.1%	21.0%	19.0%	56.5%	76.4%			27.1%	58.8%
1982	17.4%	14.2%	1.3%	1.1%	20.0%	19.4%	54.9%	76.4%			28.1%	59.3%
1983	18.2%	14.4%	1.3%	1.1%	20.2%	19.5%	57.9%	76.4%			37.8%	59.5%
1984	18.7%	14.7%	1.1%	1.1%	21.0%	19.9%	57.8%	76.1%			36.6%	60.0%
1985	18.2%	15.1%	1.3%	1.1%	20.5%	20.7%	57.4%	76.5%			26.4%	59.8%

Note: Figures for pre-school or special education not included. Figures for high school include junior high.

Source: Ministry of Education, EDUCATIONAL STATISTICS OF THE REPUBLIC OF CHINA, 1987, pp.18,20,38, & 42.

Table 12: Educational Expenditure as a Percent of GNP and of Total Government Expenditure

Fiscal Year	Total Government Expenditure (NT$)	Total Education Expenditure (NT$)	Educ. Expenditure as a % of Total Govt Expendit. (%)	Educ. Expenditure as a % of GNP (%)
1955-56	5,808,999	673,263	11.6	2.1
1960-61	11,037,305	1,671,962	15.1	2.5
1965-66	22,187,853	3,959,628	17.8	3.3
1970-71	54,906,850	11,236,766	20.5	4.6
1975-76	139,130,086	25,377,015	18.2	4.2
1980-81	409,667,961	74,112,578	18.1	4.7
1985-86	686,622,474	138,667,203	20.2	5.5

Source: Educational Statistics of the Republic of China, MOE, 1987, p.40.

Table 13: Educational Expenditure as a Percent of GNP and of Total Government Expenditure for Selected Countries

Country	Year	Educ Expenditure as a % of GNP	Educ Expenditure as a % of Total Gov't Expenditure
United States	1981	6.8	n/a*
W. Germany	1980	4.7	10.1
United Kingdom	1980	5.7	13.9
Japan	1982	5.7	19.1
Italy	1979	5.0	11.1
Greece	1979	2.2	10.1
Korea	1982	4.3	21.5
Singapore	1982	4.4	9.6
Malaysia	1982	7.6	18.4**
Taiwan	FY1982-83	5.8	19.9
Thailand	1982	3.9	20.3
Canada	1981	7.0	17.0

Source: Taiwan - MOE, Educational Statistics of the Republic of China, 1987.
Other Countries - UNESCO Statistical Yearbook, 1985

* for 1975 the U.S. figure was 18.1%

** Peninsular Malaysia only

Table 14: Educational Attainment of the Labor Force, 1966 - 1985
(percentage distribution)

Year	Total	Illiterate	Self-taught and Primary	Junior High	Senior High	Senior Vocational	Jr. College, Univ. & Above
1966	100.0	20.0	57.1	10.2	3.5	5.3	3.9
1971	100.0	16.3	57.3	12.3	3.3	6.9	3.9
1972	100.0	14.9	57.1	12.7	3.7	7.3	4.3
1973	100.0	14.6	54.8	13.6	3.8	8.1	5.1
1974	100.0	14.0	54.7	14.4	3.8	8.4	4.7
1975	100.0	12.3	52.3	15.2	4.5	9.7	6.0
1976	100.0	10.8	51.5	15.9	5.0	9.9	6.9
1977	100.0	9.9	50.4	16.6	5.5	10.1	7.5
1978	100.0	8.6	48.9	17.3	6.1	10.6	8.5
1979	100.0	7.7	47.0	18.4	6.3	11.6	9.0
1980	100.0	6.7	44.6	18.7	6.9	12.7	10.4
1981	100.0	6.5	43.1	19.2	7.1	13.2	10.9
1982	100.0	6.3	41.7	19.4	7.2	14.3	11.1
1983	100.0	6.5	40.3	19.3	7.0	15.4	11.5
1984	100.0	6.2	38.8	19.4	7.2	16.3	12.1
1985	100.0	6.0	37.5	19.9	7.2	17.0	12.5
1986	100.0	5.6	36.0	19.9	7.2	18.2	12.9

Source: Council for Economic Planning and Development, TAIWAN ECONOMIC DEVELOPMENT PLAN: MANPOWER AND DEVELOPMENT SECTOR, MEDIUM AND LONG-TERM PLANS, 1986-2000, (in Chinese) Republic of China, Aug. 1986, p. 15.

Table 15: Summary of MDP Plan Targets and Results

1. Shift from General to Vocational Education at Sr. High Level

Plan	Target	(Voc:Gen)	Actual	Ratio	(Voc:Gen)
			1963	45:55	
1966	1st MDP	60:40			
			1972	52:48	
1977	5th MDP	70:30			
			1980	66:34	
1981	7th MDP	70:30			
			1986	72:28	

2. Rate of Increase of Student Enrollment in Colleges and Universities

	Target			Actual
			1970-71	9%
1972	4th MDP	5% (max.)		
			1975-76	3%
1977	5th MDP	3% (max.)		
			1980-81	4.4%

3. Educational Expenditure Indexed as a Proportion of GNP

	Target			Actual
			1970	4.6%
1971	3rd MDP	6% by 1980		
1972	4th MDP	5.4% by 1976		
			1976	4.5%
1980	6th MDP	5-5.5% by 1989	1980	4.4%
			1986	5.5%

Sources: Chang, Pei-Chi, "Higher Education and Manpower Planning in Taiw the Republic of China," INDUSTRY OF FREE CHINA, July, 1980,
Hou, Chi-ming, "Manpower Planning and Development in Taiwan," INDUSTRY OF FREE CHINA, Aug. and Sept., 1978, and
Hou, Chi-ming and Ching-hsi Chang, "Education and Economic Grow in Taiwan: The Mechanism of Adjustment," in CONFERENCE ON EXPER AND LESSONS OF ECONOMIC DEVELOPMENT IN TAIWAN, Academia Sinica, Taiwan, 1981.

Table 16: Percentage of Higher Education Students in Science and Engineering Subjects for Selected Countries (%)

Country (year)	Commercial and Business Admin.		Natural Science		Math & Computer		Engineering		Medical Science	
	BA	Grad	BA	Grad	BA	Grad	BA	Grad	BA	Grad
China '83 (1)	5.3	4.1	6.3	15.5	3.6	7.1	36.5	37.4	13.1	11.5
Greece '80 (2)	14.8	-	8.7	-	6.9	-	10.8	-	10.6	-
Italy '83	1.4	0.0	7.3	0.0	3.4	1.6	8.8	0.5	17.2	85.5
Japan '83 (3)	39.2	10.5	2.3	9.0	0.9	1.6	18.9	32.1	6.4	15.3
Korea '83	9.5	15.9	5.3	4.8	2.4	1.8	23.1	14.3	4.3	9.9
Malaysia '82	8.0	7.4	17.7	15.9	2.5	2.4	8.5	1.2	9.0	3.1
Singapore '83(4)	15.2	15.5	13.8	4.0	0.0	0.0	19.0	20.8	6.3	3.7
Taiwan '86	20.5	10.2	5.7	10.2	6.4	5.7	17.9	31.3	8.6	4.1
U.K. '81	5.8	12.5	12.7	13.2	3.9	2.9	12.1	11.3	6.5	6.8
U.S.A. '84	11.4	18.8	1.1	3.7	0.9	1.3	4.7	7.1	0.0	6.1
W.Germany '82	2.2	0.1	8.5	22.0	4.2	2.5	15.7	3.6	8.2	6.7

Notes: 1. Figures for commercial and bus. admin. students include social and and behavioral science.
2. Graduate data not available.
3. Figures for commercial and bus. admin. students include law, social and behavioral science. Figures for engineering students include architecture, town planning, trade, craft and industrial programs.
4. Figures for natural science students include math and computers.

Sources: Taiwan - Ministry of Education, EDUCATIONAL STATISTICS OF THE REPUBLIC OF CHINA, 1987.
U.S.A. - Dept. of Education, DIGEST OF EDUCATION STATISTICS, Center for Education Statistics, 1987.
Other Countries - UNESCO STATISTICAL YEARBOOK, 1985, Table 3.13.

Table 17: Supply and Demand for Scientific and Technical Manpower - Current Years and Forecasts
(university level and above, unit = thousands of persons)

Field	1986 - 1989			1990 - 2000			1986 - 2000		
	Supply	Demand	Difference	Supply	Demand	Difference	Supply	Demand	Difference
Humanities	7.0	5.1	1.9	6.9	5.3	1.6	6.9	5.2	1.7
Law	5.2	2.7	2.5	5.5	3.3	2.2	5.4	3.1	2.3
Business Admin.	8.9	10.0	-1.1	9.7	13.1	-3.4	9.4	12.2	-2.8
Natural Science	3.9	3.2	0.7	4.9	4.6	0.3	4.6	4.3	0.3
Engineering	9.9	11.6	-1.7	11.8	18.5	-6.7	11.3	16.8	-5.5
Agriculture	1.2	1.0	0.2	1.4	1.1	0.3	1.4	1.1	0.3
Medicine	2.6	3.7	-1.1	3.1	5.2	-2.1	2.9	4.9	-2.0
Education	1.4	2.4	-1.0	2.8	3.6	-0.8	2.4	3.3	-0.9
Total	40.1	39.7	0.4	46.1	54.7	-8.6	44.3	50.9	-6.6

Source: Council for Economic Planning and Development, 'Taiwan Economic Development Plan, Manpower Development Sector, Medium and Long-Term Plans, 1986 - 2000' (in Chinese) Executive Yuan, Republic of China, Aug. 1986, p.56.

Table 18: Ratio of Male Salaried Workers to Total Employees on Payrolls of Electronic Products Manufacturing - Selected Years

Unit: person

Year & Type	Total	Male	Percent Male Salaried to Total Wkrs
1976			
Total	67,404	20,673	12.0%
Salaried Wkrs.	11,839	8,098	
Wage Earners	55,565	12,575	
1980			
Total	99,346	31,994	13.6%
Salaried Wkrs.	19,203	13,559	
Wage Earners	80,143	18,435	
1983			
Total	88,819	24,804	10.7%
Salaried Wkrs.	15,209	9,502	
Wage Earners	73,619	15,302	
1986			
Total	114,668	37,111	14.6%
Salaried Wkrs.	22,765	16,762	
Wage Earners	91,903	20,349	

Source: Directorate-General of Budget, Accounting and Statistics, YEARBOOK OF LABOR STATISTICS, Republic of China, 1987, p. 85

Table 19: Percent Female Students in Higher Education for Science and Technical Subjects SY1986-87

	Grand Total	Graduate School PhD	Graduate School MA	University	Two-Year Jr. Coll.	Three-Year Jr. Coll.	Five-Year Jr. Coll.
Grand Total	442648	2143	11294	184729	58205	29532	156745
% Female	43%	13%	24%	44%	47%	53%	42%
Business Adaministration	98187	107	1264	37913	15925	10458	32520
% Female	68%	15%	25%	59%	82%	63%	76%
Natural Science	12283	249	1119	10525	0	0	390
% Female	24%	13%	23%	24%	0%	0%	51%
Math & Computer Science	16411	112	657	11734	502	1246	2160
% Female	35%	6%	11%	26%	84%	78%	58%
Medical Science	37544	113	435	15924	1399	363	19310
% Female	56%	34%	40%	27%	88%	70%	78%
Engineering	145717	762	3439	33127	29365	4090	74934
% Female	11%	2%	4%	8%	13%	20%	11%
Arch. & Town Planning	5745	0	168	2952	711	0	1914
% Female	20%	0%	14%	17%	12%	0%	27%
Agric Forest & Fish	14004	172	633	5256	1647	2830	3466
% Female	38%	18%	31%	40%	40%	32%	42%

Source: Ministry of Education, EDUCATIONAL STATISTICS OF THE REPUBLIC OF CHINA, 1987, p.110.

Table 20: Return Rates for Chinese Students Studying Abroad - 1950 - 1986

Year	A Total Studying Abroad	B Total Returned From Abroad	B/A
1950	216	6	2.8
1955	760	34	4.5
1958	674	91	13.5
1960	643	47	7.3
1965	2,339	120	5.1
1970	2,056	407	19.8
1975	2,301	569	24.7
1980	5,933	640	10.8
1985	5,979	1,350	22.6
1986	7,016	1,583	22.6
Total '76 -'86	59,366	10,606	17.9

Source: Educational Statistics of the Republic of China, Ministry of Education, 1987.

Table 21: Distribution of Chinese Students Studying Abroad by Country and Subject Matter (%) - 1986

Country	U.S.A.	Japan	W. Germany	France
Total (persons)	6499	182	103	80
Subject (%)				
Education Science	1.2	1.6	1.0	0.0
Fine Arts	1.4	1.6	6.8	15.0
Humanities	10.4	24.2	40.8	67.5
Social & Behavioral Sci	6.9	6.0	2.9	0.0
Business & Admin	17.9	14.3	4.9	2.5
Law & Jurisprudence	1.5	2.2	8.7	5.0
Natural Science	7.8	2.7	5.8	0.0
Math & Computer Sci	6.0	0.0	1.9	1.3
Medical Science	4.2	3.8	1.0	0.0
Craft & Industry	0.2	0.5	0.0	0.0
Engineering	30.1	20.3	14.6	2.5
Architecture, Town Plan	1.7	1.6	2.9	2.5
Agric,Forestry & Fish	3.8	4.4	4.9	0.0
Home Economics	1.0	1.1	1.0	1.3
Transport & Comm	1.4	1.1	1.0	0.0
Service Trades	0.6	1.6	0.0	0.0
Mass Communic & Document	2.2	3.8	1.0	0.0
Others	1.6	8.8	0.0	2.5
Total	100.0	100.0	100.0	100.0

Source: Ministry of Education, Educational Statistics of the Republic of China, 1987.

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