Comparative Resource Allocations to Human Resource Development in Asia, Europe, and Latin America

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Major increases in attention to and expenditure on education and health systems are needed in many developing countries, especially in Latin America, to improve the coverage and quality of the services they provide. Relying on trends and themes emerging from regional comparisons, the paper identifies an agenda for policy reform in human resource development to improve a country’s international competitiveness in the decades ahead.
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The quality of a country’s human resources will determine its ability to compete in international markets and assure the well-being of its citizens in the next century as it does in this one. Considering rapidly advancing technology, expanding global links, and threats to the ecology, it is clear that whether a society maintains or improves its competitiveness, ensures social equity, “adjusts” — or indeed survives — will ultimately depend on its success in developing its human resources. But in devising their development strategies and public expenditure portfolios, many developing societies — and among them Latin American ones are prominent — have yet to accord due attention to their most vital resource. A major issue is whether Latin American countries will be forced to sell cheap labor and over-exploit their natural resources to maintain even current, inadequate living standards. Or will these countries follow the lead of successful European, North American, and now Asian countries that have invested heavily in their human resources?

Reviewing statistics compiled for selected Latin American countries and two reference groups of countries in East Asia and northern/southern Europe, Knight and Wasty emphasize the need to increase attention to and expenditure on education and health systems in many developing countries, especially in Latin America, to improve the coverage and quality of the services they provide.

The paper notes that wider access to secondary education and greater emphasis on the quality of higher education tend to be a distinguishing feature of the better performers (East Asian and northern/southern European countries). Much of East Asia’s success can be attributed to the region’s consistent efforts to improve technical and higher education — particularly in research and development and in engineering and other technical applications. The Nordic countries, too, have provided thorough on-the-job training and established first-rate educational institutions, led by world-class research scientists in technical fields and social sciences.

In sum, since specialized technical human resources take time to develop, no country today can afford not to provide enough financial resources to develop critical human resources.
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INTRODUCTION

We know that it is difficult to bring about a transformation which takes a society out of underdevelopment solely through education; but, on the other hand, we must avoid that the nature of education, or the lack of it, blocks the possibilities of transformation and development.¹

As in the twentieth century, the quality of a country’s human resources will determine its ability in the twenty-first century to compete in international markets and assure the well-being of its citizens. A major issue is whether Latin American countries will be forced to sell cheap labor and over-exploit their natural resources to support even current inadequate living standards. Or will these countries follow the lead of successful European, North American, and now Asian countries that have invested heavily in their human resources? Today these countries are reaping the benefits in improved international competitiveness, faster economic growth, and relatively greater distributional equity.²

Two hundred years ago Adam Smith recognized the state’s responsibility toward human resource development.³ But, in devising their development strategies and public expenditure portfolios, many developing societies—and among them Latin American ones are prominent—have yet to accord due attention to their most vital resource. The 1990s are likely to be characterized by a pace of change exemplified by recent events in Eastern Europe. In the face of falling walls, rapidly advancing technology, expanding global links, and threats to the ecology, how a society maintains or improves its competitiveness, ensures social equity, “adjusts”—or indeed survives—will ultimately depend upon success in developing its human resources. The ability to learn, adapt, and create is fundamental.

This paper seeks to emphasize the need for major increases in attention to and expenditure on education and health systems in many developing countries, especially in Latin America, to improve the coverage and quality of the services they provide. To this end, we review statistics compiled to facilitate international comparisons, present current profiles of human resource development, and compare resource allocation trends in nine Latin American countries and two reference groups composed of selected countries in East Asia and Northern/Southern Europe. We have selected this sample of 23 countries⁴ on three criteria: somewhat comparable income levels, possible similarities in the historical development of their social programs, and a perception that the Asian and European countries may serve as valid comparators and/or models of relevance for Latin America. In Europe we have selected countries of northern and southern Europe which had comparatively late starts in industrialization. The analysis focuses on recent (mid-1980s) indicators of achievement in education and health, on the level and composition of central government spending, on the quality of the delivered product, and on the intensity of research and development effort. Relying on trends and themes emerging from country and regional comparisons, the paper identifies an agenda for policy reform in human resource development to enhance a country’s international competitiveness in the decades ahead.

BASIC INDICATORS

Consider first several findings that emerge from a review of the basic data and how these findings may be related to the currently accepted body of development theory.

Educators, policymakers and, more recently, economists have stressed the importance of primary education. Today, access to primary education in newly industrializing countries is virtually universal. What differentiates countries

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² This question emerges clearly from the important work of Fajnzylber (1989), which documents the extent to which the countries of Latin America lag behind a group of Asian and European countries he characterizes as “growth with equity industrializing countries”.
⁴ Argentina, Brazil, Chile, China, Colombia, Costa Rica, Finland, Greece, Italy, Korea, Malaysia, Mexico, Norway, Peru, Philippines, Portugal, Spain, Sweden, Taiwan, Thailand, Turkey, Uruguay, and Venezuela.
that have developed their human resource potential rapidly in recent years—and which are often singled out as models to be emulated—from those which have not done so well? The distinguishing feature of the better performers tends to be a wider access to secondary education and a greater emphasis on the quality of higher education. In addition, the successful countries have increased their allocation of resources to those sectors, have introduced clarity and transparency in the educational system, and have encouraged in their populations a strong desire to learn. Further, these countries produce more technical and scientific specialists, and spend more on research and development.

Today and in the future, a secondary education is the minimum requirement to assimilate high technology, and at least an undergraduate education from a university or other institution of higher learning is required to conduct the research and development associated with innovation and the creation of new technology. Technical and scientific education, and higher education in general is expensive. Through an extensive use of selection criteria, some countries choose their technical professionals from among the brightest citizens; in so doing, scarce public resources are used to help the less fortunate obtain access to higher education, not to subsidize the well-off who can afford it.

Health is valued not only in itself, but also because it contributes to the ability to learn and to the quality of work effort. Malnutrition before birth and during the first years of life can permanently stunt the brain. Declines in fertility, important for achieving sustainable development and improving the quality of human resources, are normally preceded by increasing female literacy, rising female participation in the labor force, and declining infant mortality. This "seamless web" of relationships between education, health, nutrition, and population was emphasized a decade ago in the World Bank's World Development Report 1980. The evidence reported ten years later in the World Development Report 1990, with its focus on poverty alleviation, reinforces the view that the effectiveness of education as a weapon in the fight against poverty goes well beyond productivity in the labor market. One year of mother's education has been associated with a 9 percent decrease in under-5 mortality; in general, the children of better-educated mothers, other things being equal, tend to be healthier. A strategy for a rapid and sustainable progress on human resource development must consist of mutually-reinforcing elements of education, health, nutrition, and population.

The following sections summarize the comparative basic indicators of attainment in the education and health sectors.

**Overall Levels of Educational Development**

**Adult Literacy.** Among the selected countries, the proportion of the literate in the adult population (age 15+) varies from the lowest, 65% (China), to 85%-95% in East Asia/Southern Europe/Latin America, and to the highest, 100% (Nordic countries). Notably, female literacy is not divergent from the overall adult literacy level, except in China (47%).

**Enroll. Ratios.** Both total and female primary school enrollment (first level, with minimum duration of five years) is universal; it fluctuates from 95% to 120% of the age-group (the higher figure incorporating enrollment outside the age group).

But secondary school enrollment (second level, average 3+3 years) exhibits a wide disparity across countries: Spain (98%), Taiwan (91%), Korea (75%), Mexico (55%), Venezuela (46%), and Brazil (36%). (See figure 1.) Female secondary school enrollment in some cases is even higher. Consider the same group of countries: Spain (101%), Taiwan (96%), Korea (92%), Mexico (54%), Venezuela (50%), and Brazil (36%). (See figure 2.)

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6 See in particular Chapter 5, "Human development issues and policies" for its last section on the "seamless web" (pp. 68-70). Part II of that chapter was also published as World Bank, *Poverty and Human Development* (1981).


7 Detailed tabulations are available from the authors on request.

8 Note, however, that national averages often obscure spatial differences within a country.
Figure 1: Gross Enrollment Ratio
Secondary

% 

Brazil Mex Venezuela Korea Philippines Taiwan Greece Spain Sweden Latin America Asia Europe

Source: World Bank/UNESCO

Figure 2: Female Enrollment Ratio
Secondary

% 

Brazil Mexico Venezuela Korea Philippines Taiwan Greece Italy Spain Sweden Latin America Asia Europe

Source: World Bank/UNESCO
Enrollment in higher education in all cases is less than 40% of the specific age-group (20-24). The figures vary from approximately 35% (Argentina, Korea, the Philippines, Sweden, and Uruguay)—which is roughly the average for industrial market economies—to a low of around 15% (Brazil, Colombia, Mexico, and Turkey). The low enrollment ratios in higher education in Malaysia (9%) and Taiwan (10%) possibly do not take into account a relatively large number of their students studying abroad. Again, in some instances, female enrollment in higher education is greater than country average: Argentina (42%) and the Philippines (40%).

Total Fertility Rate. Among the sample countries, Latin America as a region has the highest fertility rate of 3.5, compared to the averages of 3.0 and 2.1 respectively for Asia and Europe (see figure 3)—reflecting the probable linkage between high female secondary school enrollment and low fertility. (Usually, the effects of education on fertility are complicated. At low levels of education a few extra years of schooling may actually lead to increased fertility; but after that there is a strong negative effect).

Female Labor Force Participation. Regression results show, not surprisingly, that female participation in the labor force is negatively correlated with high fertility. As figure 4 shows, East Asian countries have the highest participation rate for women; contrast Thailand (46%) and Taiwan (44%) with Brazil (27%) and Colombia (22%).

Welfare Indicators in the Health Sector

Life Expectancy. The regional averages for all countries (from 65 to 74 years) are almost approaching those for industrialized market economies as a group (76 years).

Infant Mortality (per thousand live births). Infant mortality rates are widely considered to be among the most sensitive indicators of the extent of poverty (and the inequality of income distributio). Regression results also reiterate that high fertility is positively correlated with a high infant mortality rate.

Among the sample countries, the figures are vastly disparate. Contrast the following numbers: Sweden (6), Taiwan (7), Spain (10), Costa Rica (19), Chile (22), Korea (27), Argentina (34), Mexico (50), Brazil (67), and Peru (94). (See figure 5.)

Maternal Mortality (per 100,000 live births). Considerable differences prevail in the case of maternal mortality rates: Sweden (4), Spain (10), Costa Rica (26), Chile (55), Korea (34), Argentina (85), Mexico (92), Brazil (150), and Peru (310). (See figure 6.) These statistics say a lot about the quality and distribution of health care.

Provision of Primary Health Care. The published indicators commonly used, populations per physician and paramedic staff, do not vary much among countries with similar per capita income levels. Specifically, the per population availability of medical personnel in Korea, Taiwan, or Malaysia, is not very different from that in Chile, Costa Rica, or Brazil. The problems reflected in the above infant and maternal mortality data for some Latin American countries are perhaps also pertain to the spatial distribution and the quality of medical personnel and facilities, as well as the availability of medicines and the education of mothers.
Figure 3: Total Fertility Rate

Source: World Bank/UNESCO

Figure 4: Female Labor Force Participation

Source: World Bank/UNESCO
Figure 5: Infant Mortality
(per thousand)

Source: World Bank

Figure 6: Maternal Mortality
1980--(per 100,000)

Source: World Bank
AGGREGATE RESOURCE ALLOCATION TRENDS

The level and growth of public spending on social sectors reflects a country's overall fiscal effort to invest in human capital. To maintain comparability across countries, the trends in aggregate spending depicted here refer to central government expenditures only, though in some countries lower levels of government also finance a major part of social services, particularly education.

Expenditure on Education

Regional averages do not indicate a marked disparity in central government spending on education expressed as a proportion of GDP and total expenditures. Nevertheless, there is a wide variation among countries, the size of spending as a percentage of GDP being particularly low in Brazil (0.7%)\(^9\), Argentina (1.6%), the Philippines (2.1%), and particularly high in Malaysia (6.1%), and Chile and Costa Rica (4.1%). These numbers however need to be interpreted with caution since diversity in spending can be attributed to differences in wage structures and/or unit costs.

Of much greater concern are the negative growth rates in real per capita expenditures on education. Among the sample of 23 countries, 11 witnessed a declining annual rate of per capita education expenditures in 1980-85. Of those 11 countries, 8 are from Latin America (Turkey, Spain, and Sweden, being the other three). (See figure 7.)

Expenditure on Health

Central government spending on health (both preventative and curative) in the sample of industrial market economies in Southern Europe and Nordic countries significantly exceeds the amounts allocated in East Asian and Latin American countries. On average, the former group (Southern Europe and Nordic) allocates 5% of its GDP to the provision of health services, compared with the latter group's figure of around 1 percent. In the 1980-85 period, real per capita expenditures on health declined in 10 out of the 23 countries. Of those 10, 6 are Latin American countries (Brazil, Colombia, and Peru being the exceptions). (See figure 8.)

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\(^9\) Notably, Brazil, China, and Mexico. For example, in Brazil in 1974, total spending by federal, state, and municipal governments and other public entities totalled 28% of GDP. See: Knight, et al (1979), *Brazil Human Resources Special Report*, Annex III, p. 141, Table 50.

\(^{10}\) See: footnote 8.
Figure 7: Growth Rate of Central Government Expenditure on Education
Real Per capita: 1980-85

Figure 8: Growth Rate of Central Government Expenditure on Health
Real Per capita: 1980-85
Declines in real per capita social expenditures can have serious repercussions for the coverage, equity, and operational characteristics of the system. By simple extrapolation, the educational achievement of a country—in terms of, say, coverage or enrollment rates—tends to improve with more resources. The present levels of basic education as well as health are only a reflection of the cumulative impact of past investments in these sectors. Further, intrasectoral allocations—the distribution of expenditures by the level of education and according to purpose (salaries, maintenance, scholarships, school meals and board, and availability of adequate teaching materials)—are all adversely affected by the paucity of funds. In sum, enhanced public expenditure becomes synonymous with a government’s commitment toward human resource development.

This is not to suggest that money alone buys progress. Appreciable changes in educational outcomes do not necessarily result from relatively large increases in aggregate spending. Indeed, at times, the necessity of fiscal retrenchments may help focus policymakers’ attention on other serious problems, such as the inequity of much government spending and the poor management of many government social programs.

Also, very different outcomes are possible with comparable levels of fiscal effort; conversely, very similar outcomes can obtain with quite different levels of spending. For example, public spending on education in Thailand is comparable to that in Chile, but the coverage of the Thai educational system is much smaller; in Philippines and Malaysia, coverage is somewhat comparable, but public spending is much smaller in the Philippines, 2.1% of GDP compared to Malaysia’s 6% figure. These patterns are an early indication that sectoral policies and considerations beside higher aggregate spending have a parallel impact on educational outcomes.

**Intrasectoral Emphasis.** In all countries, central government current expenditures on education constitute roughly 85%-90% of the total government expenditures on education. A major proportion of these current expenditures is devoted to primary education. However, variation among countries becomes pronounced in terms of relative spending on secondary and higher education. There appears to be a relatively greater emphasis or secondary education in Korea, Malaysia, and Taiwan, and in countries of Northern/Southern Europe, whereas Brazil, Costa Rica, Mexico, and Venezuela spend a larger share on higher than on secondary education.

Salaries of teaching and administrative staff claim the largest portion (65% and above) of current expenditures on education. The country variations in this context do not follow any distinct trend, except for possible differences in wage structures and teacher qualifications. Several countries stand out in their expenditure on scholarships (except for the caveat that the figures depicted here may not include tuition-free education), teaching materials, and welfare (school meals and board). Noteworthy among them are Korea, Malaysia, Thailand, Norway, Spain, Sweden, Chile, and Venezuela. In some instances—Malaysia, for example—targeted scholarships and opportunities for study abroad are offered as an institutionalized way for alleviating inequities in ethnic income distribution.

**Student-Teacher Ratios.** Pupil-teacher ratios, particularly at post-primary level education, depend on such choices as the grouping of students, the use of multiple-grade teaching and of specialized teachers and other academic staff, and so forth. A higher student-faculty ratio may also reflect a higher number of classes per teacher and/or large class sizes. Both arrangements signify that teachers are used more intensively; and the available data on those counts indicates that East Asian and Northern/Southern European teachers are used more efficiently as an educational input than their Latin American counterparts.

**University-Level Enrollments by Field.** Evidence also suggests that East Asian economies have a proportionately greater enrollment in science and technology disciplines (natural science, mathematics and computer science, engineering, architecture and town planning, and agriculture).

**Research and Development Expenditures.** As regression results corroborate, a high proportion of a country’s population engaged in professional research is largely explained by its spending on research and development. Korea and Taiwan far exceed all upper-middle income developing countries in terms of their production and training of scientists, engineers, and technicians. Per million of population, research personnel are as follows: Sweden 6,000, Korea 1,900, Taiwan 1,600, Italy 1,700, Mexico 600, Chile 425, and Brazil 240. (See figures 9 and 10.)
Figure 9: R & D Expenditure
(% of GNP)

Source: UNESCO

Figure 10: Research Personnel
(Per million population)

Source: UNESCO
TOWARD AN IDENTIFICATION OF PROBLEM AREAS

What then will distinguish countries enjoying relatively higher levels of educational and health attainment in the years ahead? The available indicators already highlight the primacy of overall resources devoted to the greater access and quality of the educational and health systems. However, because of the lack of sufficient information on adequate quantitative and qualitative indicators, the country trends compared in this paper neither convey a very precise message nor permit proving a specific hypothesis. Yet, several issues assume significance for policymaking, and a review of the literature suggests some important conclusions for policymakers.

The Prominence of Universal Literacy Revisited

In their historical research project, Morris and Adelman\(^1\) explore the reasons for the extraordinarily diverse responses of the European periphery and the non-European world to the challenges and opportunities created by the early industrial rev\(^\text{olutions}.\) Several of their principal findings on the patterns of human resource development are striking. Countries attaining early widespread industrialization or balanced agricultural-industrial growth were all 50% literate by 1850. No country achieved successful growth before 1914 without adult literacy over 50%.

Five principal issues emerge from their project results: (i) the spread of literacy was consistently associated with agricultural improvements; (ii) only in overwhelmingly agricultural, mainly subsistence economies—such as Burma, India, Egypt, and China—did the results show no positive effects of literacy; (iii) literacy becomes effective only after people become well accustomed to profit calculations and commercial practices; (iv) political, ideological, and religious influences were often found more important than economic considerations in the spread of literacy; and (v) literacy in the 19th century, as today, was a powerful mechanism for increasing the receptivity to new ideas and for broadening the base for political representation.

The experience of Nordic countries, too, indicates that the early advances in education and health were important factors enabling the Scandinavians to adapt their economies to capitalistic environments and to catch up with the core countries in Europe.\(^2\)

The development of the Scandinavian educational system is marked by three distinct phases: (i) 1820-1860: emphasis on compulsory education at the lower elementary level (literacy); (ii) 1860-1939: gradually more emphasis on secondary education, with good quality higher education limited to a small section of the population; and (iii) augmentation of vocational and technical training and, from 1950s onwards, compulsory secondary education and massive expansion in the number of students at the college and university level. In financing these education investments, the central and municipal governments played their designated roles; in addition, especially at the early stage, private schools and various forms of informal education, the church, and later the trade unions served as important education sponsors.

The Merits of Educational Selection

A schooling system determined by factors other than ability induces a misallocation of present resources in education—leading to important efficiency and distributional losses. In a competitive international environment, not choosing one’s technical elite from among the brightest citizens can have a great effect on economic performance.\(^3\)

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\(^{2}\) This viewpoint is supported by Blaug (1966), pp. 303-418.


\(^{4}\) For specification of an analytical framework used to derive magnitudes of the economic cost of this misallocation, see: Piñera and Selowsky (1981), pp. 111-31.
By one estimate, developing countries could achieve a 5% higher long-run GDP if they were to have a fully reformed educational system based on merit. By another estimate, the economic pay-off of educational reforms to developing countries would be three times more than the pay-off obtained if OECD countries reduced restrictions on third world exports. Although the magnitude of those effects may be uncertain, the argument appears plausible.

The theory holds that certain, but not all, elements of social selection are amenable to policy manipulation. Within the education sector, there are basically three ways to increase the merit factor in the development of a country’s human resources: (i) assuring that as broad a group of citizens as possible enters school; (ii) determining whether they stay in school as much as possible on merit grounds; and (iii) using objective tests to determine how the few of them chosen to attend university education are selected.

The use of standardized selection tests reduces both the inequity costs and inefficiencies accruing from the misallocation of resources within education. These tests--by drawing attention at one specific time to a single, widely-understood indicator--tend to produce relatively tangible results by which to judge quality. Selection testing thereby holds the school system accountable for those results; provides an open and continuing forum on the school system’s ability to deliver results parallel to the public’s expectations; and exerts pressure on the educational system for reassessment and reform.

The general principles and policy options of standardized testing are summarized as follows:

- **The design of testing systems.** No system of examinations is designed on technical grounds alone and in isolation from the political environment. For example, aptitude testing in the United States exists because of the complex political prerogatives for communities to control their own curriculum. School-based assessments can function in Sweden because of the modest logistical prerequisites and consensus on criteria achievable in a homogeneous society. Non-multiple choice formats exist in Britain because the number of test-takers remains manageable and the definition of academic excellence has modest variation from one university to another. Multiple testing by individual colleges can function in Japan because of the level of sophistication and motivation of the test-taking population. No model exists which can be transferred to developing countries without forethought and adaptation.

- **The selection mechanism.** The mechanism adopted in this context will affect the quality of universities and therefore a nation’s future. Since universities are expected to increase levels of self-financing and to be competitive internationally, they should be assigned the responsibility of selecting their own students. Further, they should have access to school-based records of student accomplishments to assist them in their choice.

- **The testing agencies.** The quality of tests rests to a large extent on the ability of the testing agency to reduce its susceptibility to political interference and to pursue its professional ends autonomously. Agencies should therefore have their own source of finance from test fees. In the larger countries, competition among agencies might be healthy. On the other hand, test agencies subsidized by the public sector should be expected to fulfill public functions. These functions should include establishment of a strong system of analyzing test results and the feeding of this information back into the school.

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15. Pinera and Selowsky, *op. cit.* In their study the authors derive orders of magnitude for the gains in value added due to a series of educational reforms. Such reforms are ranked according to the number of educational levels whose new selection criteria becomes the level of preschool ability. Throughout this evaluation the size or capacity of each educational level is held constant so as to isolate the pure qualitative effects of such reforms.


17. For detailed descriptions of testing systems in selected OECD countries, see: Heyneman and Fagerlind (1988).
system. Testing agencies should also share with other agencies technical skills (item design, computer programming, etc.), and equipment with education research functions.

- **Tests.** Where the test-taking population is high, geographically dispersed, culturally heterogeneous, or where the test employs a new national language, the test itself could benefit from a multiple choice format. Administrative and pedagogical effects of these tests would be maximized if questions were based upon the curriculum; if they were open *ex post facto* to public scrutiny; and if they were to include all levels of skill hierarchies, from recall to synthesis.

    **Designation of the "Rules of the Game": Transparency of the Education System**

The issue of motivation and the value placed on schooling by a large number of citizens concerns the entire society and not merely the education sector. That economic returns tend to be highest in some low-income countries reflects the fact that, as a commodity, education is both scarce and in high demand.

. . . when asked "whether it is important to do well in school", secondary school students in India almost uniformly answer yes, whereas in France three students in ten say no. When asked whether they would like to "leave school as soon as possible", 10% in India, 30% in England, 45% in the United States and Sweden, and 65% in France answered yes. On almost every attitudinal indicator, students in India value school more and are more likely to consider it important and are more likely to want the opportunity to continue.\(^8\)

A mixture of material and psychological variables (parents' occupation, educational attainment, income, and possessions; number of rooms per family member; number of books in the home; etc.) are often used in the current development literature to explain why children with better than average amounts seem to demonstrate better than average performances in school. However, these indices exert powerful and consistent influences in one society, but not in another. As Heyneman points out in his analysis using Ugandan data, "academic advantage is not an inevitable condition of economic privilege".\(^9\)

Part of the motivational considerations regarding human resource development in some low-income countries stems from the phenomenon that education in those societies is lockstep in nature: lack of ability to complete primary or secondary school as a youth precludes the opportunity to proceed in education later in life. Scarcity of opportunities thus creates competition for school places from the onset of grade one, and at a level of intensity unknown in wealthier countries until college or graduate school.

Perhaps it may not be possible for a society to instill new values. Yet, a society can require certain behavior from its citizens, communicate to its youth that education is the most important task they have in front of them before becoming adults, and above all, it can introduce clarity and transparency in the working of the educational system so that its participants understand the "rules of the game".

**Development of Cognitive Skills in the Workplace**

Although it is a truism that working skills are closely linked to on-the-job experiences, the kind of learning that takes place at work remains largely invisible to the educational community.\(^20\) The workplace is a learning environment, the educational potential of which has scarcely been tapped, and educational planning for the future might

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\(^8\) Fagerlind and Munck (1981).

\(^9\) Heyneman (1979).

\(^20\) In the United States, the Office of Educational Research and Improvement in the Department of Education has conducted a detailed series of studies in industry that take a close-up look at the processes through which novice workers become experts on their jobs.
well involve new configurations of school-based and work-based learning. This is all the more important for occupations whose intellectual demands are constantly changing with the introduction of new computer-based technologies.

**Adaptation to Technological Transformation in the Decades Ahead**

The main elements of this technological transformation have been identified as:

- **the increased rate of technical innovation** (much of which is clustered in microelectronics, biotechnology, and new materials);
- **the cross-cutting nature of technological change** (which has ranged far outside the sectors immediately involved to embrace applications in most other sectors);
- **shortened technology life cycles and greater flexibility in response to customers' needs**;
- **increased automation with a smaller role for unskilled labor**;
- **increased energy and material savings**; and
- **substitution of traditional materials with new materials**.

These developments portend an increased polarization between economies that can adapt to and, better, take advantage of technical change, and those that cannot.

By consistently emphasizing widespread secondary education, the newly-industrializing countries of East Asia already provide the vast majority of their populations with a strong foundation for assimilating technical change. Coupled with intensive follow-up training at the workplace this schooling helps them achieve concomitant improvements in overall productivity. There already is a tremendous stock of technology available around the world. The successful exploitation of technology by developing economies depends more on the ability to absorb technology than to produce it. As Dahlman notes, "...there is evidence at both the firm and the country level that technological follower strategies can have high returns, at least until the technology gap with the leaders is considerably narrowed."

Further, the technological problem of a country is not confined to acquiring or adapting foreign technology. This technology must be efficiently diffused throughout the economy and indigenous technological capability must be developed. Developing technological capability requires appropriate policies affecting the demand and supply of technological personnel and their products. It also requires building the appropriate institutions and networks of interaction among the different agents. It is impossible to overestimate the necessity of a good human technical base—to monitor technological trends, assess their relevance to the specific needs of a country, and to assimilate, adapt, improve, and eventually to innovate and invent.

Current development literature often argues against subsidies to higher education at the expense of primary education. Higher education, the very top step of the learning ladder, is sometimes given the lowest priority for educational spending. A common prescription for economic development is injections of basic and especially vocational education. After all, it is extremely difficult to rationalize expenditure on another university when a high proportion of the country's population is illiterate. Yet, on a general level, a country needs good teachers as well as students. In more specific terms, two priorities among expense items should certainly be to subsidize high quality research and to promote the development of polytechnic institutes and technical universities.

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22 Ibid.
A considerable part of the East Asian success story can be ascribed to consistent investments in improving technical and higher education. In particular there was a focus on engineering and other technical applied areas and, last but not least, on intense research and development effort. The Nordic countries, too, early established high quality domestic educational institutions (led by world-class research scientists in technical fields and social sciences, including economics) and furthered thorough on-the-job training. This in turn led to advances in the quality and capacity of public administration as well as the development of private entrepreneurship which would not otherwise have taken place. There was a great deal of learning from abroad, but it is important to recognize that, especially in Sweden, an important role was played by both local adaptations of foreign technology and outright innovations. Many of these were in the fields of agriculture, infrastructure, and engineering and helped lay the technical foundations of what became Swedish-based multinational corporations.

The point to emphasize here is that a system of education and training needs to be balanced. There is an interplay among disciplines and levels of education and training that would render any unbalanced strategy untenable. Since specialized technical human resources take time to develop, no country today can afford not to give careful consideration to deciding on the levels of financial resources required to acquire critical human resources.
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TECHNICAL NOTES ON DATA

Per Capita Income Levels, Adult Literacy, and Female Labor Force Participation (mid-1980s)

i) World Development Reports, 1987 and 1989, (Basic indicators). The per capita GNP 1985 $ figures are calculated according to the World Bank Atlas method, using 1983-85 as the base period. (The use of official exchange rates to convert national currency figures to the U.S. dollar does not attempt to measure the relative domestic purchasing powers of currencies.)

ii) UNESCO Statistical Yearbook, 1988 (Table 1.3). Literacy rates refer to a percentage of literate population in the age group 15 years and over.

ii) World Tables, 1989. Female labor force participation pertains to female labor force as a percentage of total labor force.

Gross Enrollment Ratios in Education, Female Enrollment, and Total Fertility Rate (mid-1980s)

i) UNESCO Statistical Yearbook, 1988 (Table 3.2); and World Development Report, 1989 (Indicators Table 29). Gross enrollment ratio for a given level of education is obtained by dividing the total enrollment for that level of education, regardless of age, by the population of the age group which according to national regulations should be enrolled at that level. (Hence the ratio will exceed 100 if the actual age distribution of pupils spreads outside the official school ages.) These ratios have been calculated taking into account the differing national systems and the duration of schooling at the first and second level. At the third level, the figures for the population aged 20-24 have been used throughout.


Total fertility rate represents the number of children that would be born per woman, if she were to live to the end of her childbearing years and bear children at each age in accordance with prevailing age-specific fertility rates.

Health indicators (mid-1980s)

World Development Reports, 1987 (Indicators Table 1), and 1989 (Indicators Tables 32 and 28).

Life expectancy indicates the years a newborn infant would live if patterns of mortality prevailing for all people at the time of its birth were to stay the same throughout its life.

Infant mortality rate indicates the number of infants who die before reaching one year of age, per thousand live births in a year.

Maternal mortality usually refers to the number of female deaths that occur during childbirth, per 100,000 live births. Because "childbirth" is defined more widely in some countries, to include complications of pregnancy or of abortion, maternal mortality is difficult to measure consistently and reliably across countries. (The figures here are reproduced from the 1986 WHO publication, "Maternal Mortality Rates" supplemented by UNICEF's "The State of the World's Children 1989".)

Physicians, in addition to the total number of registered practitioners, include medical assistants (and "barefoot doctors") who dispense medical services. Nursing persons include qualified nurses, as well as paraprofessional personnel such as first aid workers and traditional birth attendants. Because definitions of doctors and nursing personnel vary, the data are not strictly comparable across countries.

Central Government Spending on Education and Health (mid-1980s), and Real Per Capita Expenditures on Education and Health (1980-85)

Central government expenditure comprises the expenditure by all government offices, departments, establishments, and other bodies that are agencies or instruments of the central authority of a country. It includes both current and capital (development) expenditure.

Education expenditure refers to expenditure on the provision, management, inspection, and support of pre-primary, primary, and secondary schools; of universities and colleges; and of vocational, technical, and other training institutions. Also included is expenditure on the general administration and regulation of the education system; on research into its objectives, organization, administration, and methods; and on such subsidiary services as transport, school meals, and school medical and dental services.

Health expenditure covers public expenditure on hospitals, maternity and dental centers, and clinics with a major medical component; on national health and medical insurance schemes; and on family planning and preventive care.

II) Growth Rates of real per capita expenditures (1980-85) are calculated from constant (1980) price series, and have been computed using the least-squares method.

Intrasectoral Emphasis of Central Government’s Current Expenditures on Education (mid-1980s)

UNESCO Statistical Yearbook, 1988 (Tables 4.1-4.3).

Current educational expenditure includes expenditure on administration, emoluments of teachers and supporting teaching staff, school books and other teaching materials, scholarships, welfare services, and maintenance of school buildings.

Salary are emoluments of teaching and administrative staff. Scholarship includes scholarships as well as provision of teaching materials. Welfare consists mainly of school meals and board. Other expenditure contains administration (other than personnel) and subsidies not distributed.

Student-Teacher Ratios, by Level of Education (mid-1980s)

UNESCO Statistical Yearbook, 1988 (Tables 3.4, 3.5, and 3.7).

Distribution of University-Level Education enrollments by field (mid-1980s)

UNESCO Statistical Yearbook, 1988 (Tables 3.9 and 3.10).

Humanities: humanities, religion and theology, education science and teacher training, and fine and applied arts. Social Science: social and behavioral science, including economics, political science, geography, and psychology. Science and Technology: natural science, mathematics and computer science, engineering, architecture, and agriculture. Other: Mass communication, home economics, service trades, and trade, craft, and industrial programs.

R&D Expenditures, and Research Personnel (mid-1980s)

UNESCO Statistical Yearbook, 1988 (Tables 5.19 and 5.4).

R&D expenditures refer to all domestic expenditure (current and capital) made for this purpose in the course of a reference year in institutions and established in the national territory as well as in installations physically situated abroad. R&D is defined as any creative systematic activity undertaken in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this knowledge to devise new applications. It includes fundamental research (i.e. experimental or theoretical work undertaken with no immediate practical purpose in mind), applied research in such fields as agriculture, medicine, industrial chemistry, etc. (i.e., research directed primarily towards a special practical aim or objective), and experimental development work leading to new devices, products or processes.

Research Personnel. The following categories of scientific and technical personnel are defined according to the work they are engaged in and their qualifications. Scientists and Engineers, comprising persons working in those capacities, i.e. as persons with scientific or technological training (usually completion of third level education) in any field of science, who are engaged in professional work on R&D activities, administrators and other high-level personnel who direct the execution of R&D activities. Technicians comprising persons engaged in that capacity in R&D activities who have received vocational or technical training in any branch of knowledge or technology of a specified standard (usually at least three years after the first stage of second-level education). Data concerning personnel are normally calculated in full-time equivalent. This is a measurement unit representing one person working full-time for a given period; this unit is used to convert figures relating to the number of part-time workers into the equivalent number of full-time
workers. Research Personnel presented in the table are full-time equivalent and expressed as a proportion of million population.

Data on China and Taiwan were supplemented/obtained, respectively, from the following sources:


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