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Skills, Competitiveness and Policy in Developing Countries

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This paper deals with the role of skill formation and new skill needs for building technological capabilities for developing countries to compete effectively in manufactured exports. It places the analysis in the context of rapid technical progress and globalisation, with large shifts in the location of productive and innovative activity, patterns of comparative advantage, and systems of industrial organisation and management. It describes differences (apparently growing over time) in national abilities to provide the technological effort, skill creation and FDI attraction that competitiveness now needs. It ends with policy recommendations.

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1. Introduction

This paper deals with the role of skill formation for building the technological capabilities needed by developing countries to compete effectively in manufactured exports. It places the analysis in the context of rapid technical progress and globalisation, with large shifts in the location of productive and innovative activity, patterns of comparative advantage, and systems of industrial organisation and management.[2] The ability to compete in liberalised markets (knit closer together by falling transport and communications costs) depends increasingly on the incorporation of new technologies into manufacturing and services. Moreover, since technology-intensive activities (with fast-changing product technologies and high rates of R&D spending) are growing faster than other activities, raising the long-term rate of growth requires a structural shift into more advanced technologies.

This applies to developing as much as to developed countries. Comparative advantage in the developing world is changing from the traditional base of primary resources and cheap unskilled labour to manufactured products and services incorporating higher skill and technological inputs.[3] Even activities in which low wages still constitute an important competitive advantage, technical change and new patterns of demand impose stringent skill needs. The pervasive use of new information and communication technologies in all activities mean that all countries, regardless of the level of development, have to create the capabilities to use these technologies.[4] This paper argues that while all developing countries are improving their skill base the process is highly uneven. A few newly industrialising countries have built the capacity to compete in advanced technology and skill intensive activities. A few others have expanded manufactured exports rapidly on the basis of cheap unskilled labour; these may lose competitiveness as wages rise, technologies change and skill needs become more demanding. The large majority are not participating in the process to any significant degree: their skill base is increasingly inadequate, their manufactured exports stagnant and their ability

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[2] While the role of human capital in growth is now widely accepted, there is increasing interest in changing skill needs with technical change and in the need for skill development to move into higher growth paths. See for instance Redding (1996) and Stokey (1991). For classic works on the role of skills in productivity see Harbison and Myers (1964) and Griliches (1988). For a recent review of the work relating skills and growth in developing countries see Gemmell (1996).

[3] The role of skills capital in trade goes back to the 1960s, when Keesing (1967) introduced it into standard Heckscher-Ohlin models based on factor endowments. For a more recent application see Courakis (1991) and a survey see Borkakoti (1998).

[4] On new skill needs created by information technologies, see Breshanahan et al. (1999), Colecchia and Papaconstantinou (1996) and Howel and Wolff (1992).

to attract foreign investment weak. They risk technological stagnation in a low skill, low growth trap (Redding, 1996).

2. Changing skill needs of competitiveness

The base of skills in most developing countries, with low levels of education and with capabilities acquired in protected markets, is insufficient to allow them to compete effectively in manufactured trade. Reaching 'best practice' levels of technology, management and marketing requires new skills, more advanced and varied than those needed to serve domestic markets. Even in relatively simple activities, exporting calls not just for low costs but also for very high quality levels at high volumes, fast-changing and stringent specifications and rapid turnaround with timely delivery. Thus, even such low technology activities like clothing now need demanding technical, management, design, logistic and communication skills. If the production structure is to shift from simple to complex, technology-intensive activities, skill needs grow broader and more demanding.[5]

Moreover, it is not only manufacturing processes that need new and more skills. Manufacturers now use a larger range of services to enhance their competitiveness; in fact, the line between industry and services is becoming harder to draw as many activities traditionally performed by manufacturing firms are outsourced from separate service firms.[6] In order to keep up with technical change, manufacturers also cooperate more closely with technology, research and educational institutions. National competitiveness then depends on the ability of these complementary activities to raise their skill base.

The nature of competition itself is changing: traditional modes of competition, based on low costs and prices, are being replaced by the 'new competition' driven by quality, flexibility, design, reliability and networking (Best, 1990). Firms are specialising in different segments of the production chain, outsourcing processes and services to reap economies of scale and specialisation. An important feature of globalisation is that outsourcing is occurring across vast distances across national boundaries. Such skill intensive functions as handling information

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[5] According to the ILO (1998), "In both developed and developing countries, employment of skilled workers has been on the rise… The rate of growth of employment in the period 1981-96 in advanced countries has usually been highest for professionals and technicians… In developing countries, too, this occupational category has witnessed a high growth rate, though one less disproportionate to other categories in comparison to developed countries. In contrast, the rate of growth of employment for the production and related workers category (which contains skilled manual and craft workers but mainly the unskilled and semi-skilled) has been very low, often negative, for developed countries. In the developing countries for which data are available, with some exceptions (e.g. Philippines), this group has witnessed much lower employment growth than the highly educated and trained group of professionals and technicians." (p. 32)

flows and networking are the new weapons in the competitive armoury. As The Economist noted, "over three-quarters of the value of a typical manufactured product is already contributed by service activities such as design, sales and advertising."[7]

New forms of enterprise management and organisation also create distinct skill needs. New skills are entailed in setting up new work production systems, with different hierarchies, information flows and responsibilities. These have to be complemented with new work attitudes, work relationships and management systems. The ILO (1998) identifies four features of these practices.

- Greater use of work teams, involving greater group responsibility, broader skills and frequent job rotation.
- Involvement in off-line activities like problem solving, quality improvement, health and safety.
- Flattening of organisational hierarchies, with greater responsibility by shopfloor workers and more intense information exchange.
- Tighter links to other human resource policies, with training and remuneration systems adapted to prepare and reward employees for the new responsibilities.

In addition, the increased importance of networking (between firms and between firms and technology institutions or universities) requires specific communication skills.[8] The knowledge-intensive sectors are the most dynamic in terms of their 'learning potential', so that employees who enter them benefit from a virtuous cycle of skill creation and upgrading.

3. Skills and capabilities

Human capital in most trade analysis focuses on a generic set of skills formed by the formal education and training system as distinct from skills acquired in productive activity. This is a limited definition, ignoring certain critical aspects of human capital creation related to what is called 'capability building'[9]. Much of the analysis of skills in trade (there is a long tradition of

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[6] Services are themselves increasingly exposed to international competition, as large providers go multinational and invest near major customers (the bulk of direct investment flows today is in services, UNCTAD, 1998). Thus, national service firms have to invest in new skills to survive.

[7] The Economist, 'World Economy Survey', September 28, 1996, p. 48. Also see the World Bank (1998).

[8] A recent study shows how communication skills enable skilled workers in the UK to move into knowledge-intensive sectors more readily than worker without such skills (Tomlinson, 1999).

[9] Capability building refers to the accumulation of knowledge, skills, information, work practices, external linkages and institutional structures needed to use technologies effectively and improve upon them. It is a much broader concept than 'innovation' as normally used in economics, and derives from the evolutionary models of Nelson and Winter (1982). Innovation (as the creation of completely new technologies) is one end of the spectrum of technological effort, but there is

neo-factor proportion models that extend standard two-factor H-O models to include skills[10]) tends to ignore the role of technological learning in determining comparative advantage. It simply assumes that once formal 'skills' are present, technologies can be used efficiently.[11] No distinction is generally drawn between formal skills and experience-based learning in building competitiveness; the process of skill development is oversimplified, particularly for policy purposes. Even analysts who distinguish different levels of education, and separate technical from other skills, overlook informal learning and capability development.

Technological capabilities (that is, the ability to use existing technologies efficiently rather than to 'innovate' in the normal sense) rarely appear as a determinant of comparative advantage in theories of trade. In fact, technological activity tends to play little or no role in conventional analyses of the comparative advantage of developing countries. In Heckscher-Ohlin (H-O) theories, technology and skills do not appear at all. Production functions are assumed identical across countries, with technology fully diffused across firms and countries. Firms automatically select techniques suited to their relative factor (capital-labour) prices. Once they have made the right choice (i.e. labour-intensive techniques for developing countries), they use the technologies efficiently without lags, learning or effort. Since labour is taken to be homogenous and technology users automatically reach 'best practice' levels, there is inefficiency only if governments intervene to distort factor prices or prevent free trade. Neo H-O theories, incorporating skills as a third factor of production, continue to assume efficient markets for technology and its costless and automatic application. The advantage of developing countries lies in low-skill, labour-intensive activities, with no specific effort, lag, learning or risk involved in using these at best practice.[12]

Skills are treated as a generic resource, created by 'the education system ' and generally measured by school enrolments or years of schooling (Gemmel, 1996). The possibility that the

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large range of other activities (learning, adaptation and improvement) that is also relevant and important. In developing countries, needless to say, the latter constitutes the bulk of technological effort, and is a critical determinant of industrial competence and success (Lall, 2000).

[10] See footnote 3 above. In a new departure from the traditional models, Wood (1994) changes the basic H-O assumptions by allowing for the international mobility of capital and arguing that unskilled labour no longer provides a base for comparative advantage in manufacturing activities. Thus, in his model the interaction between skills and natural resources (the two remaining immobile factors) determines the pattern of trade.

[11] There are important exceptions. Courakis and Roque (1988, 1992), explaining patterns of trade in a semi-industrial but developed country, Portugal, use a combination of skill and technology variables, explicitly focusing on the ability to adapt technologies rather than innovation as a determinant of comparative advantage. They argue that "the Portuguese pattern of trade will reflect differences across Portuguese industries in the ability to adapt to technological improvements as a direct function of the quality composition of the labour force of different industries and of research and development expenditures, since both of these will determine the degree of facility of adaptation." (1988, p. 291, italics in original).

[12] See, however, the works cited in the previous footnote as well as Teitel (1982) on the need for technical skills to absorb and adapt technologies in developing countries.

efficient use of technology needs skills and knowledge specifically related to those technologies, acquired only by prolonged experience and problem solving with those technologies, is ignored. Even technology-based (product cycle and other neo-technology) theories direct their attention to developed countries and neglect technological learning in developing countries. They take comparative advantage to depend on ‘innovation’ – discrete improvements to products or processes (or shifts of the production function). The use of existing technologies or their adaptation to local conditions (reaching or moving along the production function) remains automatic and costless. Industrial countries are the innovators; developing countries receive mature technologies from them as they percolate down and use them efficiently. As in H-O models, their comparative advantage in using mature technologies depends on low wages and skills. In these models, countries can improve their competitive positions by facilitating technology inflows, by opening their economies to trade, licensing and (particularly) foreign direct investment.

Strategic or ‘new’ trade theories, while eschewing assumptions of perfect markets, also concentrate on advanced countries. Abstracting from factor endowments, they use scale and (more recently) agglomeration economies to explain trade patterns (Krugman, 1991). Its main focus is intra-industry trade between industrial countries; in developing countries, trade remains mainly between industries and is explained by traditional factor endowments. Interestingly, ‘learning’ appears in some models as an explanatory variable, but it is taken as a form of scale economies over time: passive, automatic and predictable, dependent only on the volume of production. As such, it raises no policy issues, apart from the possibility of gaining first mover advantages. Some analysts note the causation, externalities and path dependence as determinants of competitiveness (Venables, 1996). However, this applies primarily to agglomeration processes, not to technological learning.

Developing countries are assumed to be technological followers, for whom technology is easy to find, transfer and implement. Technology markets are taken to be efficient; more importantly, 'using technology does not entail any additional cost, effort, uncertainty or learning. In this setting, all governments have to do is ‘get prices right’ so that firms will select the techniques appropriate to their factor prices. Having done this, the technologies will be automatically used at ‘best practice’ levels. There is no difference, in other words, between capacity (physical plant, equipment or blueprints) and capability (the ability to use these efficiently). Comparative advantage then depends entirely on relative factor endowments, and any attempt to change this – apart from providing the conditions for faster accumulation of factors – is by assumption inefficient.

Micro-level research suggests that this approach is oversimplified and misleading; as a result, it draws the wrong policy conclusions. The technological capability approach, drawing on the evolutionary tradition of Nelson and Winter (1982), leads to a different depiction of how firms become technically efficient, and leads to different policy conclusions. This literature (reviewed by Lall, 2000) shows that there is a significant difference between 'capacity' and 'capability'. Firms in developing countries operate with imperfect knowledge of technological alternatives. Finding technologies is a difficult, often costly, process. Once technology is imported, its efficient use requires a process of developing new skills and knowledge to master its tacit elements (Teitel, 1982); the tacit elements vary by technology. The learning process can be costly, prolonged, risky and unpredictable. It can involve externalities and coordination problems, when skills and technology 'leak' out to other firms, or when the efficiency of one firm depends on learning processes in other firms (say, its suppliers). Thus, the learning process can face market failures that prevent, curtail or distort it. The failures are particularly large in markets for skills and technology, prone to widespread information deficiencies, uncertainty and externalities.

Some technologies are relatively difficult and costly to master because the learning process is longer and more uncertain, and involves more advanced skills, greater technological effort and more externalities and coordination problems. Sustaining competitiveness also involves a technological deepening process – starting from easy activities and moving into difficult ones, and within given activities, starting from simple functions (final assembly) and moving into more complex ones (improvement, design and development). More difficult technologies offer greater rewards in terms of further learning because they generally have greater potential for further productivity increase. Several also have larger spillover effects, in particular those related to mechanical and electrical engineering. Simple technologies, by contrast, tend to have limited learning potential, smaller scope for technological upgrading and less spillover benefits to other activities. Unless countries move into more complex technologies, their competitive edge is highly vulnerable to easy entry, technical change and market shifts. Thus, the process of competitive industrial development is one of promoting more demanding and deeper forms of learning.

In this approach, competitiveness varies significantly between countries according to their 'national systems' for technological learning, even if they have similar endowments in the conventional sense. The evolution of competitiveness then depends on how effectively a country supports its enterprises in accessing new technologies and mastering them, and over time in coping with increasingly difficult learning. Traditional determinants of comparative advantage may be relevant, when their assumptions conform to the needs of capability building. For instance, relative factor costs a la H-O affect trade when technological conditions approximate conditions of perfect competition, i.e. with no scale economies, universally available technologies and no learning. These apply to simple labour-intensive technologies where small firms can make undifferentiated products, easily mastering the technologies involved: under these conditions, wage differences per se do become an important competitive factor. However, this represents one end of the technological spectrum; it certainly does not mean that H-O assumptions are generalisable across the industrial sector. In fact, simple labour-intensive products are a minor part of competitive exports by developing countries (below).

What then determines technological capabilities in developing countries? Many factors are involved: macroeconomic conditions, trade and competition policies, factor markets and institutions (Lall, 1996, 2000). Most of the markets concerned suffer from widespread failures. Given these failures, the progress and nature of learning depends on how these failures are remedied. Thus, policies on learning become determinants of comparative advantage. The case for policies to promote learning is identical to that for the role of government in industrialisation more broadly (Stiglitz, 1996). There is a valid case for policies to coordinate, guide and subsidise learning, and to develop skills and technology where externalities and information failures are particularly pervasive.

To simplify and generalise, successful development strategies fall under two broad headings.

- Autonomous strategies to accelerate and guide learning by reducing reliance on FDI and promoting domestic infant industries, coordinating investments in related activities and clusters, overcoming externalities, directing credit and developing specific skills and institutions.
- FDI dependent strategies that rely on TNCs to lead export growth and upgrading. This has two subsets of strategies: proactive strategies, of targeting TNCs and using industrial policy to guide them into more technology-intensive activities, and passive strategies, that rely on market forces to attract FDI and upgrade its activities.

Korea and Taiwan are good examples of autonomous strategies, Singapore and Malaysia of proactive FDI strategies, and Mexico and Thailand of the more passive FDI strategies. Needless to say, these categories are simplified: most countries have mixtures of these strategies. With the march of liberalisation and globalisation, however, there is now some convergence of strategies. Countries with autonomous strategies are liberalising on FDI, while those with passive strategies are trying to target more sophisticated investors and to induce upgrading of existing activities. Both sets of strategies involve intensive efforts to develop skills and capabilities.

4. Changing patterns of competitiveness

The growing role of technologically advanced products – and of related diverse skills – can be best illustrated by patterns of world trade in manufactured products. The success of developing countries in coping with these patterns is also widely divergent, with the divergences growing rather than diminishing over time. Table 1 shows the evolution of export of manufactures by technology levels. While the classification is simplified and fairly aggregate (three-digit SITC level), it is appropriate to assessing how 'dynamism' relates to technological sophistication. Resource based exports tend to have the simplest technologies and high technology products that most advanced (there are exceptions, noted below).

The figures suggest that advanced technologies are the engine of trade growth. Primary commodity exports (not shown) grow at below 2% per annum during 1980-96, compared to over 8% per annum for manufactures. Within manufactures, growth rates for the categories rise with technology intensity. The highest rate is for high technology (e.g. fine chemicals, electronics, aircraft and precision instruments) followed by medium technology products (machinery, chemicals, simple electronics and transport equipment). Low technology products (textiles, clothing, toys, simple metal products and footwear), the main comparative advantage of developing countries, grow more slowly. Resource based products grow the slowest. Of the fifty most dynamic exports in the world over 1980-1996, medium and high technology products account for a full 75 per cent by value. Within these 'ultra-dynamic' exports, high technology products grow the fastest, followed by medium technology products. Resource based products are again the laggards.

Table 1: Evolution of World Manufactured Exports by Technological Categories

	Shares (%)				
	1980	1985	1990	1995	1996
Resource based	19.5	19.3	15.5	14.0	13.7
Low tech	25.3	23.4	23.7	22.0	21.3
Medium tech	38.6	37.3	38.5	36.9	37.2
High tech	16.5	20.1	22.2	27.1	27.7
	Rates of Growth (% p.a.)				
	1980-85	1985-90	1990-95	1995-96	1980-96
Resource based	2.0	10.1	6.4	-0.2	5.7
Low tech	0.7	15.3	6.9	-0.9	6.9
Medium tech	1.6	15.7	7.7	3.0	7.8
High tech	6.3	17.4	13.0	4.5	11.6
Total	2.3	15.0	8.6	2.1	8.1

Source: Lall (1998)

Interestingly, the growth rate of high technology products outpaces that of other products even more during 1990-96, when world trade growth slows down. Thus, technology intensive products are less vulnerable to cycles (though some individual products like semiconductors are very cyclical). This suggests that a dynamic export structure is one that shifts from low to high technology activities (The US NSF, 1998, provides data to support this for 63 developed and developing countries with large industrial sectors). This is not to deny that dynamism also involves moving up the technology scale within each industry, and some countries can manage high growth rates with low technology products (like China) by enlarging their market shares. Clearly, sustaining competitiveness in any activity entails constant technology upgrading. However, technology intensive products offer better growth prospects than others do, for the following reasons.

- Activities with the rapid product or process innovation generally enjoy faster growing demand as compared to technologically stable activities.
- Technology-intensive activities are less vulnerable to entry by competitors compared to low technology activities where scale, skill and technology requirements are low. A low-technology export structure is a good starting point, but it can sustain export growth only by taking shares from other low technology exporters. In relatively slow-growing markets, this is possible but difficult. It needs considerable technical effort, high skill levels and differentiation.

- Ceteris paribus, technology-intensive activities lead to faster growth in capabilities and higher quality capabilities. They offer higher learning potential and greater opportunity for the continued application of science to technology.
- Capabilities in technology-intensive activities are more attuned to technological and market trends, and so are more flexible and responsive to changing competitive conditions.
- A technology-intensive structure is likely to have larger spillover benefits to other activities and to the national technology system.

The export growth of developing countries is consistently higher than that of developed ones. While this may be expected (they start from a small base), it is less so that developing countries are now significant exporters of high technology products. By 1995, their high technology exports ($299 billion) comprised the largest single export category, higher in value than low technology exports ($266 billion). Their world market shares of high-tech products, nearly 30 per cent, was growing rapidly, and would exceed that of low technology products in the near future if past growth rates continue. While these figures suggest that the developing world is well poised to gain from emerging technological forces, this would be a premature conclusion, for two reasons. First, sophisticated manufactured exports are highly concentrated, coming from a very small number of regions and countries. Second, a large proportion of ostensibly high-tech exports consists of simple, labour-intensive final assembly: the depth of local competitiveness differs by country.

At the regional level, Asia accounts for fully 78 per cent of the developing world's manufactured exports in 1996 (the share was identical in 1980). Latin America accounts for 17 per cent (7.5 per cent if Mexico is excluded), the Middle East for 3.5 per cent and Sub-Saharan Africa (excluding South Africa) for a mere 0.1 per cent. The Asian share is highest in high technology products (89 per cent) and lowest in resource based products (65 per cent). At the country level, only thirteen – the four mature Asian Tigers, four new Tigers (Indonesia, Malaysia, Philippines and Thailand), China, India, and the three large Latin American economies – account for over 93% of manufactured exports from developing countries. The level of concentration rises over time: in the mid-1980s, their share was around 80%. It also rises with technological sophistication. The leading five countries account for 62% of the developing world's total manufactured exports in 1996. Their share is 46% in resource based, 63% in low technology, 69% in medium technology, and 78% in high technology, exports. The same countries dominate most categories.

There are significant differences in national patterns of specialisation. Six of these leading countries – Philippines, Singapore, Malaysia, Mexico, Korea and Taiwan – have very high (over 60%) shares of advanced (high plus medium technology) products in their manufactured exports. India, China, Indonesia and Argentina are the technological laggards (with shares of below 40%). Even these laggards are more advanced than other developing countries, around half of which have shares of advanced exports below 20%, and around one-quarter below 10%.[13]

These differences suggest that only a few countries are set to enjoy fast growth in the new technical paradigm. However, there are significant differences in the technological content of manufactured exports between the leading exporters, reflecting differences in strategy and capabilities. There are indirect ways to gauge this: the technological sophistication of the processes located in the exporting country, the level of domestic content (physical and technological) and the main agents of export activity (TNCs as compared to local enterprises). In terms of process sophistication and domestic physical and technological content, the clear leaders in high and medium technology exports are Korea and Taiwan. They have high levels of local input into complex exports and provide much of the equipment, designs and skills needed in the production chain. The lowest content in high-tech exports is in countries like Mexico, Indonesia and Thailand. Singapore has low levels of physical domestic content, but is specialised in complex processes and furnishes considerable skills and designs locally.

As far as the agents of export activity go, domestic enterprises account for the bulk of manufactured exports from Korea, Taiwan, Hong Kong and India. TNCs dominate manufactured exports from Singapore, China, Malaysia, Thailand, Philippines, Indonesia and the Latin American countries. Of technology intensive exporters, only Korea and Taiwan show significant domestic competence – the others depend heavily on foreign affiliates, mainly to assemble imported components. For countries lower down the technological scale, many economies have FDI in low technology assembly of clothing (driven by the quota allocation system under the Multi-Fibre Agreement). Relatively few have 'graduated' from this into high technology products – the main site for such graduation has been South East Asia, because of the TNC relocation of electronics assembly.

By any measure of technological competence, therefore, Korea and Taiwan lead the developing world. As illustrated below, they developed their competence by heavy investments in skills,

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[13] These include relatively large exporters of manufactures like Pakistan, Sri Lanka and Bangladesh.

technology and institutional development, guided by pervasive industrial policy (Lall, 1996). Their larger enterprises are now leading TNCs, with considerable technological and marketing muscle. Singapore's success within a highly TNC-dependent strategy was also due to pervasive industrial policy on investment, skills and infrastructure.

5. Determinants of success

The main determinants of competitive success among the leading developing countries are considered under three headings: technological activity, skill formation and attraction of FDI.

Technological activity: All developing countries depend on foreign technology as the primary source of new knowledge, and access it in many ways. FDI is one major form, while equipment imports and formal technology contracts are another; but there are also various other means, such as informal contacts, copying and reverse engineering, migration, export subcontracting or OEM (original equipment manufacture) arrangements. Apart from FDI, many cannot be quantified. Patchy data are available for royalty and technical fees paid overseas. In 1997 the developing world as a whole paid $5.8 billion for technology, 14% of the world total of $41 billion. This had risen from $757.5 million in 1980, or 8.4% of the world total. The largest single technology importer in 1997 was Korea ($2.4 billion), accounting for 42% of the total for developing countries (up from 8% of the total in 1980). It was followed by Thailand ($804 m.), China ($543 m.), Mexico ($501 m.), Argentina ($241 m.), Philippines (158 m.) and India ($151 m.). Data are not available on other countries like Taiwan, Singapore, Brazil or Malaysia. The whole of Sub-Saharan Africa paid $84 m., 1.4% of the total for the developing world. Least developed countries paid $9 m. (those in Sub-Saharan Africa $1 m.).

Once technology has been imported, local effort is needed to master its tacit elements, adapt it to local conditions and improve it over time to keep up with world best practice. The capacity to mount such technological effort is the ultimate determinant of competitive success. One indicator of such effort is formal R&D expenditures. While this does not capture informal effort, it does allow us to compare one important form of technological effort across countries. While R&D is not needed to use simple technologies effectively, it becomes important as countries move to more complex technologies. R&D then becomes necessary to monitor, absorb and adapt technologies, to lower transfer costs, and to obtain technologies not easily available on licence.

Table 2 shows R&D performance at broad regional levels in the developing world, and compares this to developed and transition economies. It shows enormous differentiation.

Productive enterprise financed R&D as a share of GNP in the mature NIEs is nearly 400 times higher than in Sub-Saharan Africa, and around 10 times higher than in the new NIEs and Latin America. Asia accounts for 86 percent of R&D scientists and engineers in the developing world, Sub-Saharan Africa for 0.3 percent. Even these averages are misleading. The mature NIEs vary between themselves in technological effort. The leader in terms of R&D propensities, by far, is the Republic of Korea. The share of enterprise financed R&D in GNP is the highest, not only in the developing world, but also in the world as a whole. It runs neck and neck with Japan, and outpaces all other industrial countries. Taiwan Province comes next in the developing world, spending around the same proportion as the UK, higher than the Netherlands or Italy; Singapore follows. In terms of per capita R&D spending, the leader is Singapore (here industrialised countries have much higher figures), with Korea a close follower. Hong Kong does not publish R&D data, but reports suggest that total national R&D is only 0.5% of GNP and enterprise financed R&D is a very small proportion of this. The three mature NIEs are clearly in a different class from the rest of the developing world.

Table 2: R&D Propensities and manpower in major country groups (simple averages, latest year available)

Countries and regions (a)	Scientists/engineers in R&D		Total R&D	Sector of performance (%)		Source of Financing (% distribution)		Source of financing (% of GNP)	
	Per mill. population	Numbers	(% of GNP)	Productive sector	Higher education	Productive enterprises	Government	Productive enterprises	Productive sector
Industrialised market economies (b)	1,102	2,704,205	1.94	53.7	22.9	53.5	38.0	1.037	1.043
Developing economies (c)	514	1,034,333	0.39	13.7	22.2	10.5	55.0	0.041	0.054
Sub-Saharan Africa (exc. S Africa)	83	3,193	0.28	0.0	38.7	0.6	60.9	0.002	0.000
North Africa	423	29,675	0.40	N/A	N/A	N/A	N/A	N/A	N/A
Latin America & Caribbean	339	107,508	0.45	18.2	23.4	9.0	78.0	0.041	0.082
Asia (excluding Japan)	783	893,957	0.72	32.1	25.8	33.9	57.9	0.244	0.231
NIEs (d)	2,121	189,212	1.50	50.1	36.6	51.2	45.8	0.768	0.751
New NIEs (e)	121	18,492	0.20	27.7	15.0	38.7	46.5	0.077	0.055
S Asia (f)	125	145,919	0.85	13.3	10.5	7.7	91.8	0.065	0.113
Middle East	296	50,528	0.47	9.7	45.9	11.0	51.0	0.051	0.045
China	350	422,700	0.50	31.9	13.7	N/A	N/A	N/A	0.160
European transition economies (g)	1,857	946,162	0.77	35.7	21.4	37.3	47.8	0.288	0.275
World (79-84 countries)	1,304	4,684,700	0.92	36.6	24.7	34.5	53.2	0.318	0.337

Source: Calculated by author from UNESCO Statistical Yearbook 1997.
Notes: (a) Only including countries with data, and with over 1 million inhabitants in 1995.
(b) USA, Canada, West Europe, Japan, Australia and N Zealand. (c) Including Middle East oil states, Turkey, Israel, South Africa, and formerly socialist economies in Asia. (d) Hong Kong, Korea, Singapore, Taiwan Province. (e) Indonesia, Malaysia, Thailand, Philippines. (f) India, Pakistan, Bangladesh, Nepal (g) Including Russian Federation.

Skill formation: Skills arise from a variety of sources, such as formal education, vocational training, in-firm training, specialized employee training outside the firm, and learning on the job. The relative importance of these sources varies by economic structure, the nature of knowledge being utilised and the level of development. Basic schooling and literacy may be sufficient to absorb simple industrial technologies (though even these require a complement of some high level technical and managerial manpower). Advanced schooling and tertiary education become important as more complex knowledge is tackled. Sophisticated modern technologies require high levels of numeracy and a broad base of skills on the shopfloor. They also need a high proportion of technical personnel. Among these, the role of engineers merits particular attention (Teitel, 1982).

It is difficult to compare skill formation across countries. Clearly, on-the-job skill creation is difficult to measure – and impossible to quantify at the national level. Data on enterprise training are patchy and incomplete (though its significance is reviewed below). The available data only allow us to compare enrolments across countries for similar levels of formal education. This also has problems. The definitions of education levels are not uniform. The quality of education at similar levels differs greatly, as does the relevance of the curriculum. Enrolment rates do not show differences in completion rates. Nevertheless, enrolment data are available on a comparable basis, and the rates reveal something about the base for skill acquisition. Table 3 shows broad enrolment patterns.

Table 3: Enrolment Ratios (percentage of age groups)

Mean for group (unweighted)	Enrolment Ratios (1980)			Enrolment Ratios (1995)		
	1 level	2 level	3 level	1 level	2 level	3 level
Developing countries	88	34	7	91	44	11
Sub-Saharan Africa	74	17	1.3	78	23	2.9
MENA	88	42	9.7	92	59	14.3
Latin America	102	45	14.1	103	53	18.1
As ia	95	44	7.4	99	54	14.4
4 Tigers	106	72	13.0	100	82	36.4
4 new Tigers	103	43	12.3	102	60	17.3
S Asia	75	28	4.0	93	42	4.8
China	112	46	1.3	120	69	5.7
Others	96	37	3.7	98	35	5.9
Transition economies	100	77	14.6	95	76	22.2
Developed Economies	102	84	27.2	104	113	50.6
Europe	101	82	24.5	104	113	44.6
N America	101	91	49.1	102	102	92.0
Japan	101	93	30.5	102	99	40.3
Australia, N Zealand	111	84	27.0	106	132	65.0

Source: Calculated from UNESCO, Statistical Yearbooks, various.

The regional enrolment rates are simple averages, not weighted by the relevant populations. They show increases in enrolment rates in all regions. They also show large disparities, mirroring those shown earlier in technological effort. Sub-Saharan Africa lags at all, particularly the tertiary, levels of education. The four mature Tiger economies of Asia lead the developing world at higher levels, just slightly lagging the developed economies.[14] The four new Tigers, Latin America and Middle East/North Africa are roughly similar in their secondary and tertiary level enrolments, just behind the levels reached in the transition economies. South Asia and China have low levels of tertiary enrolment, but China is considerably stronger at the secondary level. To the extent that these simple indicators of skill formation are valid, they show large gaps in the education base for competitiveness.

These figures conceal differences in completion rates, quality and relevance to skill needs. While we cannot correct for these, it is instructive to consider one indicator of the quality of mathematics and science school training. This is given by the Third International Mathematics and Science Study (TIMSS) scores for 8th Grade students. Of the 41 countries in which half a million 13 year olds were tested, the position of Asian Tigers was as follows: Singapore was first place in both mathematics and science; Korea second in mathematics and fourth in science; Hong Kong fourth in mathematics and 24th in science. Japan was the best among developed countries, coming third in both. Of other developing countries, Thailand was half way down in both, while Iran did poorly in science but better than Thailand in mathematics. Kuwait, Colombia and South Africa took the last three places in both subjects. These figures confirm large quality differences in the two subjects of critical importance to technological skill development. While most developing countries are not in the test, it would not be surprising if the quality ranking was similar to the enrolment rates, with East Asia coming on top and Sub-Saharan Africa at the bottom.

[14] For a detailed analysis of skill formation strategies in the mature Tigers, and how these relate to larger industrial policies, see Ashton et al. (1999).

Table 4: Tertiary level enrolments and enrolments in technical subjects (1995)										
	3 level enrolment		Technical enrolments, numbers & % of population							
	Total	% pop.	Natural Science		Math's, computing		Engineering		All Technical subjects	
	No. students		numbers	%	numbers	%	numbers	%	numbers	%
Developing countries	35,345,800	0.82%	2,046,566	0.05%	780,930	0.02%	4,194,433	0.10%	7,021,929	0.16%
Sub-Saharan Africa	1,542,700	0.28%	111,500	0.02%	39,330	0.01%	69,830	0.01%	220,660	0.04%
MENA	4,571,900	1.26%	209,065	0.06%	114,200	0.03%	489,302	0.14%	812,567	0.22%
Latin America	7,677,800	1.64%	212,901	0.05%	188,800	0.04%	1,002,701	0.21%	1,404,402	0.30%
Asia	21,553,400	0.72%	1,513,100	0.05%	438,600	0.01%	2,632,600	0.09%	4,584,300	0.15%
4 Tigers	3,031,400	4.00%	195,200	0.26%	34,200	0.05%	786,100	1.04%	1,015,500	1.34%
4 new Tigers	5,547,900	1.61%	83,600	0.02%	280,700	0.08%	591,000	0.17%	955,300	0.28%
S Asia	6,545,800	0.54%	996,200	0.08%	7,800	0.00%	272,600	0.02%	1,276,600	0.10%
China	5,826,600	0.60%	167,700	0.02%	99,400	0.01%	971,000	0.10%	1,238,100	0.13%
Others	601,700	0.46%	70,400	0.05%	16,500	0.01%	11,900	0.01%	98,800	0.08%
Transition economies	2,025,800	1.95%	55,500	0.05%	30,600	0.03%	354,700	0.34%	440,800	0.42%
Developed economies	33,774,800	4.06%	1,509,334	0.18%	1,053,913	0.13%	3,191,172	0.38%	5,754,419	0.69%
Europe	12,297,400	3.17%	876,734	0.23%	448,113	0.12%	1,363,772	0.35%	2,688,619	0.69%
N America	16,430,800	5.54%	543,600	0.18%	577,900	0.19%	904,600	0.31%	2,026,100	0.68%
Japan	3,917,700	0.49%	N/A	N/A	N/A	N/A	805,800	0.10%	805,800	0.10%
Australia, NZ	1,128,900	5.27%	89,000	0.42%	27,900	0.13%	117,000	0.55%	233,900	1.09%
Source: Calculated from UNESCO (1997) and national sources										

The breakdown of tertiary enrolments in technical subjects is probably more relevant to assess the capabilities to absorb technological knowledge; of this, enrolment in engineering is probably the most significant. Table 4 shows the total numbers enrolled in tertiary education and in the three main technical subjects (science, mathematics/computing and engineering) by region in 1995. This time the regional averages are weighted by population. The figures show much wider dispersion in skill creation than the general enrolment rates. The Asian NIEs enrol over 33 times the proportion of their population in technical subjects that in Sub-Saharan Africa (including South Africa). The ratio is twice that of industrial countries, nearly 5 times Latin America and the new NIEs, and over 10 times South Asia and China. The leading 3 countries in terms of total technical enrolments – China (18%), India (16%) and Korea (11%) – account for 44 percent of the developing world's technical enrolments, the top ten for 76 percent and the top 20 for 93 percent.

Let us now consider enterprise training. Enterprise training (as distinct from, and generally coming after formal schooling and vocational training) is one of the most important sources of skill formation. The current technological paradigm raises its importance, accelerating change in skill needs and making many skills very task specific. There is a broad consensus that developed countries, and within them the leading enterprises, invest more in training than smaller enterprises and those in developing countries. Training takes place in all settings, of course; otherwise workers would be incapable of performing the simplest tasks. However, the duration, content and nature of training differ considerably.

Training in enterprises can be a very effective and economical way to develop the skills of the workforce (Middleton et al. 1993). Employers tend to be well-informed about skill needs (though they may not be equally aware of training methods and its rewards). Some have the expertise and resources to train in traditional and emerging skills. Their costs tend to be low as compared to pre-employment post-school training, though they lose part of the benefits of training is their employees leave. Enterprise-based training yields higher private returns than other post-school training modes, both in developing and industrialised countries. In these other modes, there are significant risks of providing inappropriate or unnecessary skills. In addition, enterprise training is an essential complement to new investment in technology, plant and equipment as well as new organisational methods. Many studies in mature industrial countries suggest that the shortage of appropriate worker skills is a major constraint on the adoption of new technologies, while well-trained workers accelerate this adoption.

Studies in developing countries demonstrate that training can raise productivity in the firm, and improve its technological capabilities (Tan and Batra, 1995). However, many firms do not provide training, despite its demonstrated gains in productivity. Some are unaware of the benefits or methods of training, while others fear the loss of trained workers to other firms. Training is a form of investment in employees' human capital – and it involves costs: in materials, time and foregone production. Thus, the incidence of training is highly variable. The most important determinants are the worker education (educated workers are better learners and benefit more), firm size (large firms spread fixed costs across a large number), capabilities of employers and the presence of training institutions able to deliver training at low cost. Payoffs to training depend on the technology used by firms, their export behaviour, and growth of markets. The lowest payoffs to training are in Sub-Saharan Africa, characterised by poor growth and macroeconomic policies, protected markets, high levels of government regulation and low levels of educational attainment. Firms there provide minimal on-the-job training; most are unaware of their skill deficiencies; some that are do not know how to go about training.[15] At the same time, poorly educated workers are costly to train, and make the introduction of new technology unviable.

Table 5: FDI Inflows, 1986-97

	INFLOWS ($ m)							INFLOWS (shares)	
	1986-91 Ave.	1992	1993	1994	1995	1996	1997 (prov.)	1986-91	1997
World	159,331	175,841	217,559	242,999	331,189	337,550	400,486	100.0%	100.0%
Developed countries	129,583	120,294	138,887	141,503	211,465	195,393	233,115	81.3%	58.2%
West Europe	66,470	85,837	83,877	78,417	122,779	99,954	114,857	41.7%	28.7%
North America	54,674	23,662	48,302	53,571	69,596	82,851	98,994	34.3%	24.7%
Other	8,439	10,796	6,708	9,515	19,090	12,588	19,263	5.3%	4.8%
Developing countries	29,090	51,108	72,528	95,582	105,511	129,813	148,944	18.3%	37.2%
North Africa	1,196	1,582	1,579	2,364	1,262	1,313	1,811	0.8%	0.5%
Sub-Saharan Africa	1,673	1,589	2,068	3,329	3,874	3,515	2,899	1.1%	0.7%
Latin America, Caribbean	9,460	17,611	17,247	28,687	31,929	43,755	56,138	5.9%	14.0%
Developing Europe	88	214	264	405	467	1,029	796	0.1%	0.2%
West Asia	1,329	1,827	3,447	1,518	-746	303	1,886	0.8%	0.5%
Central Asia	4	142	424	896	1,561	2,084	2,627	0.0%	0.7%
South and East Asia	15,135	27,683	47,348	58,265	66,571	77,624	82,411	9.5%	20.6%
Central and Eastern Europe	658	4,439	6,143	5,914	14,214	12,344	18,424	0.4%	4.6%
Memo Item									
Least Developed (43)	781	1,463	1,747	844	1,096	1,965	1,813	0.5%	0.5%
African LDCs	590	470	558	548	880	1,214	1,162	0.4%	0.3%
Oil exporting (24)	8,786	15,019	17,214	23,820	21,786	24,106	30,890	5.5%	7.7%

Source: UNCTAD, World Investment Report 1998.

Poorly educated entrepreneurs and managers hold back training efforts. In the UK, for instance, one reason for training lags is the low level of qualifications of industrial managers compared to

[15] For a study of Ghana see Lall et al. (1994), and for three East African countries see Lall (ed.)(1999).

Germany (Finegold and Soskice, 1988). Combined with the other deterrents to training noted above, this has led the UK to a 'low skill trap', where poor educational qualifications, weak training and low levels of technology used interact with each other. A similar phenomenon – with much greater intensity – is likely to obtain in poor countries with backward education systems and without public funds and institutions for training.

Foreign direct investment: World trade is increasingly related to TNC activity. TNCs now account for very large shares – over two-thirds – of world trade (UNCTAD, WIR 1996). Their shares are higher in technologically advanced and differentiated products, and are rising in response to liberalised trade and investment policies. International production does not replace the export of products at the top of the technology scale (from headquarters or from other advanced affiliates) or at the bottom (from affiliates in low wage countries). It also raises the trade in intermediate products. Thus, a very large part of TNC trade is now intra-firm. In the USA, for instance, exports by TNCs to their majority-owned affiliates in 1996 comprised 48% of parent company exports, up from 41% in 1977. Half of exports by foreign TNCs in the USA (accounting for 20 per cent of US exports) were also intra-firm.

This suggests that increasing sophisticated exports require the participation of TNCs for most developing countries. However, few developing countries are able to participate in this dynamic system. While FDI flows to developing countries have grown rapidly, from an average of $29 billion in 1986-91 to $149 billion in 1997, they are highly concentrated (Table 5). In particular, the least developed countries, particularly those in Sub-Saharan Africa, are marginalised to FDI flows. The leading 10 developing country destinations for FDI in 1997 account for nearly 80 percent of total flows to developing countries, the top 25 for 95 percent. The bottom 50 developing countries together account for only 0.8 percent.

6. Implications for skill development policy

The ability to compete is not merely unevenly distributed across developing countries, the distribution is growing more uneven over time. There are cumulative effects at work. Countries that have established the skill and technological learning systems to compete with new technology are increasing their lead over those that have lagged. In a globalizing and liberalizing world, the instruments available to the latter to accelerate the development of technological capabilities are becoming steadily more constrained. In particular, such tools as infant industry protection, local content rules, export and credit subsidies, restrictions and performance requirements on foreign investors and so on have been – or are in danger of being

– banned. However, there are still many policies governments can undertake to raise their skill levels: human resource development is an area strongly favoured by the new rules of the game and the multilateral development organisations.

There is a large literature on why education and training ‘markets’ fail to provide socially desirable levels of investment (Stevens, 1999). The failures arise for all components of the system: trainees, employers and institutions providing training. Moreover, these failures can interact with each other. In the absence of effective policy action they can result in a ‘low skill equilibrium’ where enterprises adjust to poor education standards and their own unwillingness to train by adopting simple, stagnant technologies. With poor prospects for high skill work, the demand for advanced education and training remains low, and institutions satisfy this with low quality, often obsolete, educational products.[16]

Market failures in skill formation can arise at two levels: the general level of resource allocation and deepening of the industrial and technological structure, and at the narrower level of the education and training system proper. Let us take them in turn.

Discussions of skill formation do not usually consider the general level, though there are good reasons to do so. Many skills vital to industrial upgrading and competitiveness arise not from formal education and training but from the practical experience of mastering, adapting and improving specific technologies. The extent to which this occurs depends on investment in the productive sector, the agents involved, the competitive regime and the use of new technologies. Promoting experience-based skills calls for a conducive investment and competitive environment: sound macroeconomic management, high rates of investment, outward looking trade regimes and open domestic markets. However, it often calls for more.

A fully liberal policy regime is not the best setting in developing countries for skill development when there are heavy, prolonged and unpredictable costs in mastering difficult technologies (difficult, that is, relative to existing capabilities). They deter entry into complex activities or more demanding technical functions. They are generally greater when new skills are needed, technologies need considerable effort and information to absorb, there are extensive spillovers, and domestic (rather than foreign) firms are involved. In these conditions, capability development requires policy intervention: there is a case for “infant industry” protection of skill and technology development. Such promotion can take many forms and encompass many markets (Lall, 1996, Stiglitz, 1996). Once governments set about changing the technological structure of industry, they create the need for new skills that only they can foresee. They have to ensure, in other words, that the education and training system is co-ordinated with the industrial system as both evolve: this coordination becomes an integral part of industrial and education policy (Ashton et al. 1999, Green et al., 1999).

The management of industrial policy is not, however, an easy matter. Most policy interventions in developing countries have led to technological stagnation and inefficiency rather than dynamic growth. However, the case of the countries that succeeded suggests that efficient interventions can accelerate dramatically the process of skill and capability upgrading. Given risks of government failure, all interventions need to be carefully designed, integrated across different factor markets and monitored. There is a large literature on this subject that is not directly germane to this analysis, but it is essential to bear this larger context in mind. We return to some implications below.

At the second level, the education and training system, issues better covered in the literature. The failures for each of the three components of the system are as follows. For the trainee:

- Externalities: The failure to recoup all the benefits of educational investments. Some benefits of skill creation inevitably accrue to others, since skills are not used in isolation.
- Information gaps and uncertainty: Individuals may not know of the future value of investments in education and training or of particular skills, and they may not know what skills are needed in the future.
- Risk aversion: Even if individuals can forecast the probability of getting returns on skill investments, they may prefer more certain short term returns to available jobs.
- Lack of certification of skills acquired during enterprise training: This makes the investment in such training less attractive, since its value to other firms is reduced.
- Capital market deficiencies: Individuals may not be able to finance their learning costs and foregone earnings, because capital markets lack the information and monitoring capacity.

For the education and training system (public and private):

- Lack of information on educational needs in industry and demands from students
- Capital market deficiencies in raising the funding for better standards
- Uncertainties about future skill trends, greater in a period of rapid technical change and overwhelming in a situation where skill needs are determined by industrial policy.
- High costs of educational services provided.

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[16] To quote ILO (1998), "Economies which fail to ensure an adequate supply of skilled labour may find that the whole economy becomes adjusted to a low level of skills, or to a low-skills equilibrium. This may have negative effects on the long-term comparative advantage and growth of the economy" (p. 68, italics in original).

- In the public training institutions, bureaucratic and rigid management, poor remuneration and inadequate incentives for trainers, lack of interaction with the market, and low standards. This can lead to obsolete and irrelevant curricula, poor teaching and equipment, and over-emphasis on abstract rather than practical training.
- In the private sector system, risks of variable and unsatisfactory standards in the absence of effective monitoring.

For enterprises providing training to their employees:

- Low absorptive capacity on the part of poorly educated workers.
- Low educational qualifications on the part of employers and managers.
- Lack of appreciation of or information on the benefits of training, and lack of knowledge of 'best practice' technology and skills in relevant activities.
- Lack of training materials or teachers in-house.
- Inability to form efficient training programmes in line with changing skill and technology needs.
- Lack of specialised institutions to provide appropriate training at reasonable cost, or lack of necessary interactions between these institutions and enterprises.
- Lack of finance to cover costs of training.
- Lack of full appropriability, as trainees leave for better jobs after training. This creates a bias toward training in specific skills that do not have value to other firms, but this is rarely possible.
- Lack of technological dynamism, with enterprises content to stay with existing technologies, equipment and skill levels. This is exacerbated by policy regimes that stifle competition or hold back exposure to world markets.

There are thus many economic explanations for market failures in the provision of skill related investments in any country. They apply with greater force the less developed the country, with the paradoxical result that countries with the lowest skill levels – and so the greatest skill needs – face the greatest difficulty in providing new skills.

The appropriate policy response at the general level is careful targeting and implementation. While the new rules of trade and investment restrict many instruments, it is still possible to guide resources into higher value activities within a free trade setting. For instance, Singapore, widely regarded as having the most highly skilled workforce in the developing world and one of the most effective training systems, used its skill system as a major selling point to attract high-tech TNCs in a free trade regime. Skill provision was closely integrated with industrial policy; TNCs playing an important role in determining the nature and content of training. The Economic Development Board, the body in charge of targeting FDI and formulating industrial policy, coordinated the whole effort.

As far as the education and training system is concerned, there is a universal need to upgrade the quantity, quality and relevance of instruction (Middleton et al., 1993). The first step is to benchmark the education and training system against major competitors. This is not straightforward, because of differences in quality, definitions and so on. However, after adjusting for these differences, it is possible to make meaningful assessments of how effective national systems are. The next step is to address the various market failures noted above in the demand and supply of education. A huge variety of policy responses exist, ranging from public provision to largely private led systems.

The vocational training system, particularly relevant to technical skills, falls into three broad categories ILO (1998):

1. The cooperative system: Here training is left neither to employer or employee decisions nor to government planning, but emerges after interaction between the three parties. This generally involves strong workforce representation on works councils. Germany is the best known example of this system.[17] Employers offer apprenticeship in all sectors, taking in over half the relevant age group. Chambers of Industry and Commerce are heavily involved in registering apprentices and setting qualification standards. Training is provided by public vocational schools, with half the cost borne by employers; the apprentices also make a contribution by taking low wages. The qualifications are nationally recognised, and strong unions discourage poaching. This is the basis of the 'high skill equilibrium' in Germany. A number of Latin American countries also have a similar system based on vocational training institutions.
2. Enterprise based systems: These rely primarily on training provided by enterprises, with Japan on the one hand (providing massive amounts of training to long-staying employees) and the USA and UK on the other (with voluntary training). This is often blamed for UK's low skill equilibrium; in the USA, deficiencies of enterprise training are offset by a larger supply of engineering skills.
3. The state-driven system: This also has two variants. First, the mature NIEs had a strong role of government in meeting fast-changing skill needs. In Korea, in particular, the government created skills in advance of setting up new industries (Green et al., 1999). Second, the former socialist economies as well as in many developing countries had state-led education, generally with low levels of efficiency.

All systems are under pressure as competitive forces mount and technical change proceeds unabated. It is imperative for governments to respond to these pressures if they are to participate fully and gainfully in globalisation (and staying out is no longer a viable option). How they should respond in particular social, economic and institutional settings is a complex matter to which there is no general solution. Certainly this paper cannot go into these issues.

In conclusion, there is no ‘optimal’ skill creation system for all countries – each must find its own system to suit its needs and conditions. However, it is generally true that a very important role remains for policy intervention to promote skill formation. Policies that cut countries off from world markets and technology flows, hampered their human capital development and stifled technological learning and deepening, have to be quickly removed. They have to be replaced by more carefully crafted policies geared to efficient human resource and technology development. Free markets themselves cannot lead countries to develop the systemic abilities they need to cope efficiently with new technologies. The exact nature of policies needed for each country cannot be prescribed in general a priori terms; what I have sought to do in this paper is to illustrate the general trends and lay out the general considerations that should drive the choice.

[17] For a recent analysis of the German system and its response to globalisation and unemployment see Culpepper (1999).

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