Technical change and the new context for development

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Published as: Perez, Carlota (1994) "Technical change and the new context for development", in Lynn Mytelka ed., *South-South Co-operation in a Global Perspective*, OECD, Paris, pp. 55-87

Table of contents

Introduction

For the past two decades the world has been shaken by three successive waves of change. First there was the all-pervasive impact of information technology on products, production, services and communication. Then there was the managerial revolution with the diffusion of organizational practices pioneered by the Japanese and other challenges to traditional mass production emerging in various countries of Europe and elsewhere. Now, while those two are still unfolding, there is a wave of political and institutional change involving processes as diverse and complex as the dissolution of the Soviet system, the movement towards trade liberalization, the adoption of market systems and the creation of regional blocs in every continent.

These waves of transformation in technology, management, economics and politics are interrelated. They point to a world in transition where the rules of the game are changing at every level. The conditions under which competition takes place in international markets are moving further and further away from those that prevailed in the 1960s and 1970s or even the early 1980s. In this changing environment, it is wise to reassess afresh every policy, every development strategy, because the previous success or failure of a particular policy is unlikely to be a good predictor of future performance.

One of the most striking examples of how a once effective policy can become inadequate under changing conditions is the Import Substitution Industrialization (ISI) strategy adopted by many developing countries from the 1950's onwards. Although initially it did achieve significant results in developing industrial capacity, infrastructure, skills and managerial competence, by the early eighties to persist in these policies became counterproductive. A basic necessity for the development of new strategies, however, is an understanding of the processes of technical, organizational and institutional change which, though starting in the North, are transforming the entire world economy, North, South, East and West. This paper, therefore, will examine the way in which technical and organizational innovations have changed the context for development strategies and consequently for any complementary actions in terms of cooperation between countries. It will attempt to indicate some of the new opportunities and constraints confronting the developing countries in the 1990's.

The first section looks at intangible investment. The new development strategies will need to increasingly stress knowledge accumulation, in contrast with traditional development strategies which were heavily oriented towards fixed capital accumulation. Among the most important components of intangible investment are education and training, scientific and technical services and technology infrastructure. These are discussed in Sections 3 and 4. However the appropriate scale and direction of these types of intangible investment must be carefully considered to increase their effectiveness. For this reason Section 2 analyzes the organizational changes which are needed at the enterprise level for developing countries to succeed in the new competition. This analysis shows that even though the initial intangible investment in reorganization may be quite modest, it is an essential pre-condition for the success of the other tangible and intangible investments which may follow. Moreover the pattern of organizational change which is required, with its strong emphasis on flexibility, initiative at all levels and multi-skilling has rather strong implications for the human resource strategies discussed in Section 3 and the technology strategies which are the subject of Section 4.

Successful development strategies in the 1990's and the early decades of the 21st Century will however depend not only on these kinds of tangible and intangible investment but also on appropriate specialization within the international economy. Such specialization must clearly vary a great deal with size of the economy, level of development, human resources, factor costs and of course the endowment of each country in natural resources.

In the past developing countries have been wary of excessive dependence on primary commodity export specialization because of the extreme vulnerability to price fluctuations and to shifts in the patterns of demand. However the new technologies and the new organizational principles are revitalizing and upgrading all branches of the economy, including the primary sector. The resource endowment of each country and the experience

accumulated in their exploitation can be a great source of competitive strength provided they are used as a platform for a whole constellation of new developments. The historical examples of Sweden and Finland show that export strength in primary commodities can be the starting point for strengthening many related branches of manufacturing and services which are mutually reinforcing and provide greater security and breadth of development. The question of achieving appropriate strategic specialization and market targets in the new forms of global competition are the subject of Section 5.

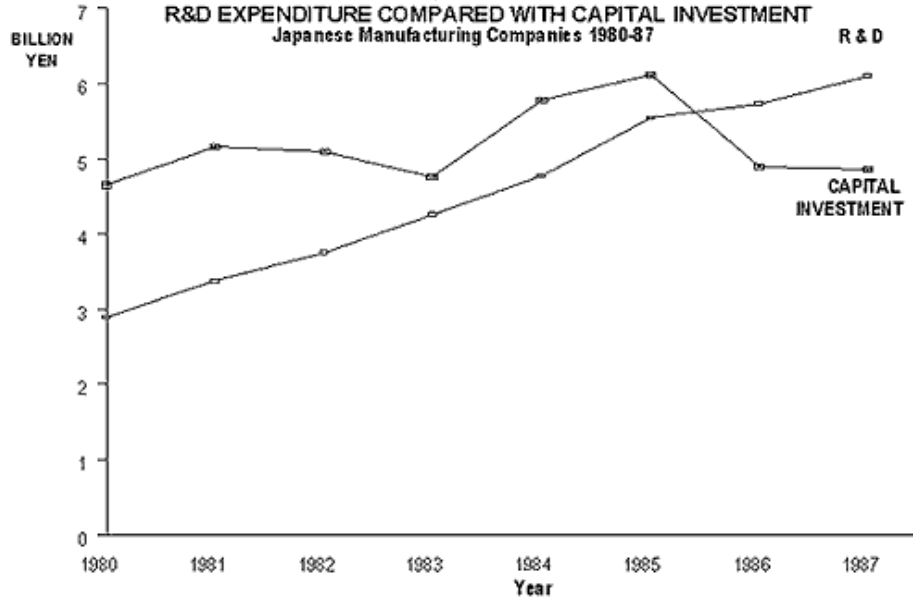
Whatever the specialization, collaboration with partners in other countries has become an imperative. The importance of global networking for education and technology already emerges in Sections 3 and 4 but Section 5 explores some aspects of global networking in production and marketing. A wide variety of possible forms of international collaboration is opening up, most of which depend on the initiative and flexibility of the relevant enterprises. There are of course many barriers and great difficulties confronting firms in developing countries, not the least of which is the heritage of established and now obsolete attitudes, customs and institutions. The final section sums up the constructive new approaches which can help developing countries to overcome this dead weight from the past and to embark on a new forward trajectory. Some of the emerging possibilities for South-South cooperation are considered in this overall context.

1. The Growth of Intangibles in Investment

In the advanced countries it is widely recognized that increasing R&D efforts are becoming crucial for competition at the frontier of technology. In certain areas such as semiconductors, super-computers and optoelectronics, these costs are reaching such proportions that both industrial consortia and government support are often considered necessary to share the burden. It is less well known that the overall amount of investment in manufacturing R&D in advanced countries is approaching the level of investment in plant and equipment. In Japan, for example, R&D expenditure by manufacturing companies surpassed tangible capital investment by 1986 (See Fig.1). From these and other data Fumio Kodama argues that manufacturing companies are moving "from producing to thinking organizations". Although the exact significance of these data is open to discussion there is no doubt that they represent an important new phenomenon and that this marks a shift in the usual notions of investment.

Yet the growth of research and development, in the traditional sense of financing laboratory research with the purpose of bringing up new products and processes, including technological breakthroughs, is only one aspect and not the most comprehensive way of defining the transformation that affects the role of technology in competitiveness.

Figure 1



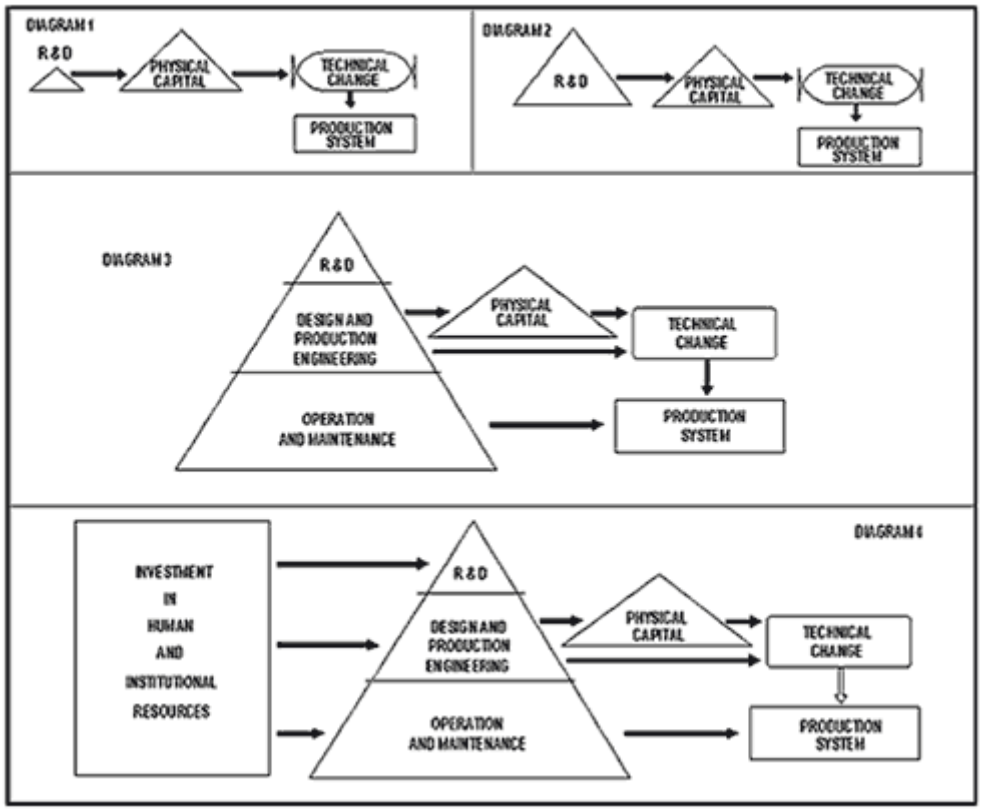
An effort to capture the whole range of areas where knowledge investment is becoming important is made in the Report of the OECD's "Technology Economy Programme" (OECD-TEP) which approaches the question of intangible investment in a wide sense. The Report recognizes "the increasing importance of technology, skills and organization in determining competitiveness" and shows that "as these production factors replace previous factors (capital, labor, land) in determining comparative advantage, there has been rapid growth in the intangible components of investment". These include R&D, purchase of patents and licenses, software, market exploration and development, training, human resource management, strategic reorganization of enterprises, etc.

There are also shifts in the composition of intangible investment itself. Surveys by the IFO Institute in Germany, quoted in the same report, not only verify the steady growth of the share of intangibles in innovation-related investment from 1979 to 1988 but also identify, within it, the faster growth of expenditures other than R&D, such as new product training, reorganization and process improvement.

Martin Bell, from the Science Policy Research Unit of the University of Sussex, has discussed this shift in focus, emphasizing not so much the actual structure of expenditure in precise quantities but the relative importance of the effort. After all, the development of human capital could cost many times less than the purchase of the equipment to be operated, but increased mastery of technology can have greater impact not just on potential productivity from machinery but on how soon and how consistently such potential can be realized.

Figure 2 represents the evolution of the relative importance and the increased visibility of the various components of managerial effort and investment. In it Bell is essentially pointing out three things: a) the growing awareness of the centrality of investment in knowledge in relation to physical plant and equipment; b) the visibility of the whole iceberg of technology-related effort in industry, of which R&D is only the tip and c) the recognition of investment in human and institutional resources as the means to activate the potential for technical change.

FIGURE 2
COMPONENTS OF MANAGERIAL EFFORT AND INVESTMENT:
EVOLUTION OF RELATIVE IMPORTANCE AND VISIBILITY



It is important to note that Chris Freeman, the consultant who drafted the 1963 "Frascati Manual", used by the OECD to gather R&D statistics, had insisted that these indicators be complemented by a range of other measurements of "related activities". These comprised all of the main components of intangible investment such as geological exploration, design activities, project survey work, information services, training and testing. But it is only thirty years later, in December 1992, that the OECD feels the need to hold a Conference on the measurement of intangible investment. As a result the 1990's are likely to see a big push forward in this area of statistics.

The growing role of intangible knowledge-related investment has enormous consequences for developing countries. It obviously needs to be taken into account by firms as they reconvert to become competitive. It is also a key aspect in the design of national strategies and government policies. An understanding of the changes taking place in the world economy and in the factors determining competitiveness is essential both to establish appropriate enabling conditions and to avoid misdirected efforts.

Policy recommendations from a wide range of sources are already drawing attention to technical change as a key element in development strategies under the new conditions. Notably the ECLAC Report "Changing Production Patterns with Social Equity" takes the assimilation of technical change and the development of human resources as the core of its proposals. The World Bank's 1991 World Development Report highlights the contribution of technology and education as a significant complement to macroeconomic policies in achieving development.

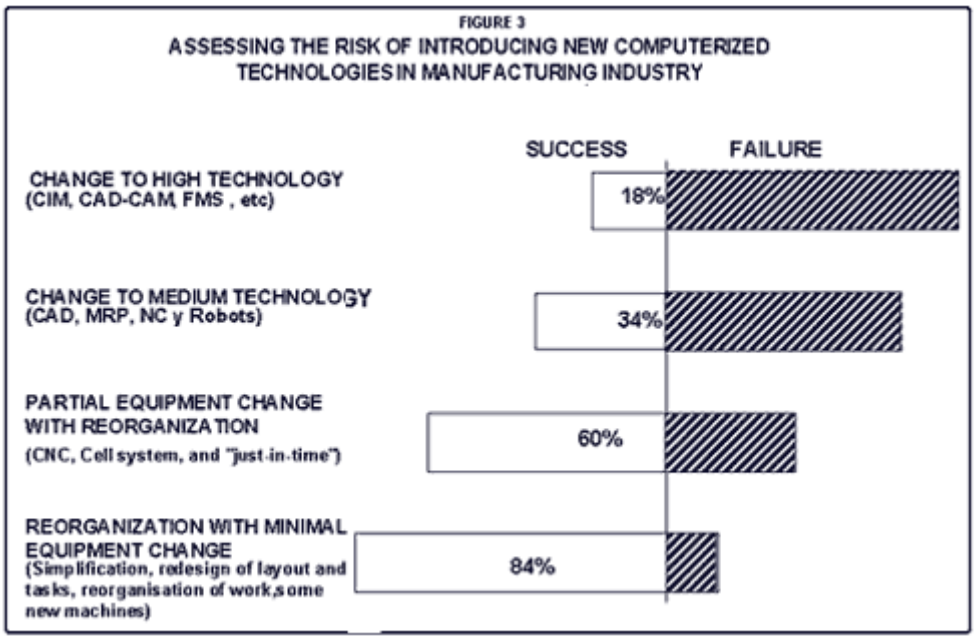
The following sections examine three of the main aspects involved in this transition towards a more knowledge centered production system: organizational change, the role of human capital and the mastery of technology. The changes occurring in each of these areas will be described with a view to exploring how they might affect the restructuring strategies of firms and countries in the developing world. Particular reference is made to the ISI policies which were prevalent until recently and to how this legacy may help or hinder the necessary transformations.

2. Investing In Organizational Change

In the early eighties, when awareness of the microelectronics revolution was at its peak and debates raged alternately heralding its promises and fearing its threats, Ingersoll Engineers came up with a set of surprising results from a survey of British manufacturing. When assessing the risk of investment in automated technologies their results showed an inverse relationship between the level of automation and the likelihood of achieving increased productivity. In fact, they found only an 18% rate of success in firms that went for the "high technology" option, in contrast with an 84% success rate in firms that focused mainly on reorganization, introducing only a few selected changes in equipment (See Fig.3).

Rather than conclude that computer integration and flexible manufacturing systems (FMS) cannot yield expected results, what Ingersoll argued is that organizational change is a precondition for reaping the potential benefits offered by the new equipment. They also found that there is considerable leeway to improve production processes through organizational change that can be undertaken before any new equipment is incorporated. In some of the cases they studied as much as 80% of the initial improvements in productivity could be attributed to reorganization alone.

These findings are in line with the increasingly accepted explanation of the productivity paradox in the OECD countries. At a time when investment in modern equipment was growing rapidly and new technologies had been widely applied, instead of the expected increase in efficiency there was a decline in the rate of productivity growth in these economies. The TEP Report locates the main causes of this phenomenon in the "various diffusion barriers including human resources, organizational and management practices and more broadly the surrounding social, economic and institutional environment.



After several years of great interest in microelectronics and the information technology revolution, the center of concern thus shifted to another wave of equally pervasive but "soft" generic technology. By the mid-eighties the managerial revolution, centered on the new organizational practices developed in Japan, had become the focus of a debate in terms of promises, threats and applicability. Slowly it came to be understood that the greater success of Japanese firms was rooted in an organizational model which allowed them to take much better advantage of modern technologies. Since then there has been a mushrooming of consultancy services in the new organizational practices, various "gurus" in the field have appeared and many books and journals are propagating the new principles, their diverse forms of application and the many specific examples of success or failure in using them.

a. Organization as the Achilles heel of the traditional technology leader

In 1986 the Massachussetts Institute of Technology set up a special Commission on Industrial Productivity (MIT/CIP) to address the causes of the decline in U.S. competitive performance. It convened more than fifteen top academics in economics, technology management and political science who mobilized dozens of expert researchers to probe into manufacturing companies in eight industries in three continents. Their results point clearly to the organizational issues, rather than to hard technology.

The report groups the causes of the loss of U.S. competitiveness into six categories:

1. Outdated strategies
2. Short time horizons
3. Technological weaknesses in development and prodution Neglect of human resources
4. Failures of cooperation (within the firm and with other firms and supporting institutions
5. Government and industry at cross-purposes

As can be seen, the great majority are social, organizational and institutional weaknesses. The first two relate to overall managerial attitudes to business. The last two refer to the relationship of firms to other actors in their environment. The fourth is directly related to human capital. Only the third is truly "technological" in nature. And yet, when it is spelled out it turns out to be mainly related to management of technology and attitudes towards it. It includes: neglect of manufacturability in product design, lack of teamwork in the product development process,

lack of attention to the manufacturing process itself and poor exploitation of the potential for continuous improvement in the quality and reliability of products and processes. When the MIT Commission analyzed the determining features of competitive American firms, it also found that at the root of their achievement were certain common patterns of managerial and organizational practice. Thus, organizational technology seems to underlie competitiveness as much as mastery of specific technologies, product innovation and generic technologies.

b. A change in common sense and the difficulty of diffusion

What is happening in the field of management and organization can be understood as a replacement of the established paradigm for best practice. It is an upheaval in common sense notions of efficiency. The principles that are today recognized as leading to competitiveness are almost all in direct opposition to traditional views. These are presented in two "pure" models in Figure 4.

As regards the shape of the firm, the ingrained ideas of centralized command, pyramidal structures and functional compartments are being replaced by flat flexible networks with increasing decentralization of decision-making in structures where top management takes on a truly strategic and coordinating role. The goal of standardizing and optimizing operational procedures and specializing people in clearly defined tasks is being superseded by a trend towards flexible and adaptable systems based on multi-skilled personnel and continuous learning and improvement. Similar contrasts exist for each of the other characteristics.

But this is not just a collection of new management techniques. Rather these trends converge into a coherent system, a model or paradigm of best practice which is proving superior in achieving higher productivity, quality and overall competitiveness in international markets. It is thus generating powerful signals which induce imitation. Even under strong competitive pressures however the diffusion of the new organizational patterns from one firm to another confronts great hurdles and obstacles, especially mental blocks and personal or group resistance. A change in mentalities, attitudes and behavior is far more demanding than the introduction of modern equipment.

Yet the people who occupy leadership positions today and must make the decisions for change are likely to have reached the top by applying the very principles that are now being questioned. It is very difficult to accept that what worked in the past has to be replaced by other practices; that one's competence is threatened with obsolescence. The MIT-CIP report put it very succinctly in relation to the U.S.: "it is the very magnitude of past successes that has prevented adaptation to the new world".

Certainly, the transition implies that entrepreneurs, managers, labor leaders and government officials must discard a significant part of their accumulated human capital, of their cherished routines, of their hard earned experience. Thus transformations do not and cannot occur overnight. They take decades.

Elsewhere we have suggested that the delay in implementing change in the old front runners is one of the elements opening a window of opportunity for the lagging countries to accelerate development during paradigm transitions. Another is the availability of generic all-pervasive technologies that are capable of rejuvenating mature technologies and revitalizing traditional ones. In so doing, they can reduce an important part of the gap that had been built on the type of experience which is made obsolete by the technical and organizational shift.

Figure 4
THE NEW VS. THE TRADITIONAL PARADIGM:
A RADICAL AND DIFFICULT SHIFT IN MANAGERIAL COMMON SENSE

	CONVENTIONAL COMMON SENSE	NEW EFFICIENCY PRINCIPLES & PRACTICES
COMMAND AND CONTROL	Centralized command Vertical control Cascade of supervisory levels "Management Knows best"	Central goal setting & coordination Local autonomy/Horizontal self-control Self-assessing/self-improving units Participatory decision-making
STRUCTURE AND GROWTH	Stable pyramid growing in height and complexity as it expands	Flat flexible network of very agile units/Remains flat as it expands
PARTS AND LINKS	Clear vertical links/Separate specialized funtional departments	Interactive, cooperative links between functions along each product line
STYLE OF OPERATION	Optimized smooth running organizations Standard routines and procedures "There is one best way" Definition of individual tasks Single function specialization Single top-down line of command Single bottom-up information flow	Continuous learning and improvement Flexible system/Adaptable procedures "A better way can always be found" Definition of group tasks Multi-skilled personnel/Ad hoc teams Widespread delegation of decision making Multiple horizontal and vertical flows
PERSONNEL AND TRAINING	Labor as variable cost Market provides trained personnel People to fit the fixed posts Discipline as main quality	Labor as human capital Much in-house training and retraining Variable posts/Adaptable people Initiative/collaboration/motivation
EQUIPMENT AND INVESTMENT	Dedicated equipment One optimum plant size for each product Each plant anticipates demand growth Strive for economies of scale for mass production	Adaptable/programmable/flexible equipment Many efficient sizes/Optimum relative/ Organic growth closely following demand Choice or combination of economies of scale, scope or specialization
PRODUCTION PROGRAMMING	Keep production rhythm; Use inventory to accomodate variation in demand Produce for stock; shed labor in slack	Adapt rhythm to variation in demand Minimize response time ("Just-in-time") Use slack for maintenance and training
PRODUCTIVITY MEASUREMENT	A specific measure for each department (purchasing,production,marketing,etc.) Percent tolerance on quality and rejects	Total productivity measured along the chain for each product line Strive for zero defects and zero rejects
SUPPLIERS, CLIENTS AND COMPETITORS	Separation from the outside world: Foster price competition among suppliers Make standard products for mass customers Armsength oligopoly with competitors.The firm as a closed system	Strong interaction with outside world: Collaborative links with suppliers,with customers and, in some cases, withcompetitors (Basic R&D for instance)The firm as an open system

c. Reorganization as an effective option of modernization

Recent experience in developing countries has shown that much ground towards competitiveness can be covered with organizational efforts and modest investment in intangibles. There are many examples of impressive cost reductions and quality improvements, of successful rationalization and specialization that have resulted from managerial reconversion. Such cases show that not all modernization processes involve great expenditures in new equipment.

One particular study that does quantify the initial trade-off between hard and intangible investment is the case of a U.S. paper mill presented in the Harvard Business Review. It is worth summarizing it here as an illustration of the type of effort involved and the sorts of results that can be achieved.

In 1983 the mill was losing a million dollars a month and was the last of the five suppliers in their part of the market. Equipment modernization costs were estimated to be $23 million with a timetable of at least five years to reach break-even. The choice was filing for bankruptcy or trying the reorganization route. They did the latter.

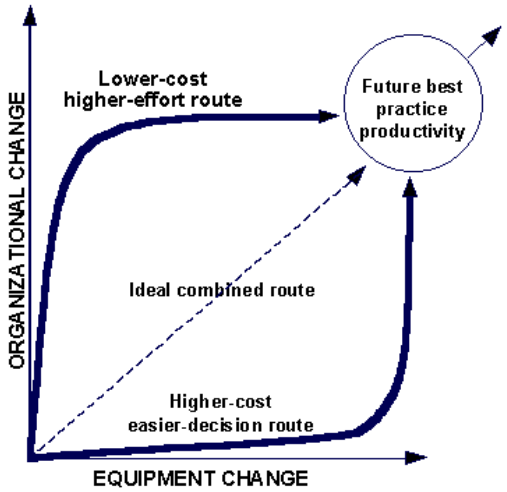
The company decided to turn everyone into a problem solver. "Together, managers and mill workers learned to take the initiative not just for identifying problems but also for developing better processes for fixing problems and improving products... The entire organization learned how to learn". They established contact with customers, pinpointed the flaws that had to be corrected, went to the root causes in their process and, in the end, not only corrected those problems (going to "zero defects") but actually developed a new thinner paper grade which created a profitable niche in the market.

In less than two years the mill was making profits, by the third year they had become the number one supplier in their group with a tenfold rise in prices per share and capable of financing expansion out of profits.

This case could be seen as a metaphor for the type of transformation that developing countries might be wise to attempt in this transition. With scarce investment capital and without much time to spare to achieve results, it makes a lot of sense to take the organizational route to modernization and to concentrate resources on learning.

To start by investing in new equipment means in most cases the highest financial cost although it is probably the line of initial least resistance and minimum effort (See Figure 5).Established practice both in firms and credit institutions assumes this to be the "normal" route. Yet, it is increasingly recognized that reorganization cannot be avoided and is in fact required if full benefits are to be reaped from the introduction of new equipment.

FIGURE 5
ASSIMILATING THE NEW TECHNOLOGIES:
OPTIONAL ROUTES FOR MODERNIZATION



Choosing to begin by reorganizing has several advantages, one of which is the trade-off between maximum effort and minimum

cost. This is obviously important when investment funds are scarce. But, as the example of the paper mill illustrates, it can be a better route independently of cost comparisons. Increased innovativeness allows each step to be financed by the previous, leading therefore to greater financial autonomy.

Many individual examples show that a sequence of investment moving from intangibles to tangible equipment can optimize both short and long term returns. A process of reconversion that begins with market analysis and focusing and goes on to investment in human capital and technological learning, can be followed by a series of incremental improvements to the existing equipment and process as well as to the products and, by collaboration with suppliers, to improve material and technical inputs. This sequence leads to a full understanding of the potential and limitations of the machinery in place and to a much greater capacity to select the new equipment when the moment comes to incorporate it. Often, as in the case of the paper mill, cash flow from success in the earlier phases can finance each subsequent one.

A point worth making is that this sequence is not only applicable to the modernization of existing plant but helps to avoid waste in hard investment when designing new production facilities. In many instances, the customary practice of estimating market demand for the medium term and setting up a plant of that future scale is no longer advisable. Instead of living with idle capacity (and having funds tied down in it) the lowest possible module is used at start up and capacity is stretched to follow the increase in market demand through incremental improvements, additional shifts or even partial subcontracting. When the next module is finally added, it incorporates the stretching improvements and takes advantage of the people trained in the extra shifts. This is of course not possible in all cases. Bulk production for the standardized portion of any market is likely to remain dependent on a large enough scale of production for cost competitiveness. But as soon as more specialized segments are envisaged, modularity becomes a possibility. Of course in some cases smaller modules in equipment are simply not yet available and in certain cases they might never be. Yet, even in steel, minimum scale has already come down from two million tons to 300.000. Therefore, the range of options depends heavily on the market niche being targetted, on the specific product, the particular technology and even the moment in time.

Nevertheless, the principle of avoiding idle capital is generally applicable, sometimes in rather indirect and imaginative ways. For instance, electric utilities in the U.S. have been able to postpone investment by purchasing extra power from large customers who have generating capacity and using it to cover peaks in demand or by financing energy conservation in the clients' premises.

Finally a note of warning. The emphasis placed here on the growing importance of organizational issues must be situated within the current period of restructuring and transition. It is not intended to deny the need for new equipment or R&D efforts. In the medium and long term the balance between investing in managerial change or in product and process innovation is biased towards the latter. Once the new managerial principles become the shared common sense and point of departure, a greater effort will be required in product and process technology. Facing these costs, which are likely to grow as the process of restructuring proceeds, is one of the tasks that might more effectively be met through international linkages. Intercountry arrangements established in this transition phase, moreover, might contemplate from the start this probable evolution.

We shall return to the theme of market segmentation and international linkages in Section 5, but we now turn to the issue of human resources without which neither technical nor organizational change can be implemented.

3. Investing In Human Capital

As the new technologies and organizational principles spread across firms, industries and countries there is a growing realization that skills and people are becoming central to competitiveness. This heightened role of human resources is being used to explain an important part of the success of firms and countries and has become one of the main criteria for policy recommendations. The new circumstances can be forcefully summarized in the words of Sylvia Hewlett: "In the last decade of the twentieth century, human capital will become the prime source of wealth and power for individuals, corporations and nations."

The irony of this recognition is that hardly more than a decade ago, the main concerns were about the expected negative impacts of the diffusion of information technology on employment and skills. That early simplistic view about massive reduction in manpower needs and widespread deskilling of the workforce was gradually replaced

by a deeper understanding of the complex combination of trends and countertrends, job and skill displacement, replacement, extension, redefinition, elimination and creation that accompany the diffusion of an all pervasive wave of technical change.

As concerns the impact of new technologies on skills it can be considered that " the debate has largely been settled in favor of upskilling" for most levels of employees and workers, including blue-collar. There are changes in skill profile which vary from industry to industry and from country to country, but the trend with the widest social and economic consequences is the general increase in skill intensity as the new technologies and managerial techniques propagate. This obviously does not mean that every job in the economy of every country will be upskilled. It does mean that most jobs in competitive firms will require higher and growing skills as opposed to the permanent use of unskilled workers by major firms in the mass production system of the past.

Thus an important policy recommendation of the MIT-CIP report is to increase "learning for work and at work" because experience shows that "successful adaptation to the new economic environment involves workers, technicians and managers using technology in ways that require good preparation and continuous learning on the job".

a. From people as cost to investment in people

Companies engaging in the organizational transformation discussed above have found that competitiveness hinges more and more on the capabilities not only of managers, engineers and supervisors but of every single one of their workers. So much so that the most advanced firms no longer consider expenditure in employee and worker training as a cost but treat it explicitly as an investment.

Estimates of returns on this very intangible form of asset are hard to come by, but MOTOROLA, a firm that has systematically engaged in a wide range of educational and training activities has calculated a 30:1 return on such investment.

One of the main reasons for this growing need for a skilled -or rather multi-skilled- workforce is the trend towards more segmented and rapidly changing markets. To compete in this shifting world environment, firms need to accelerate their response capability, to augment their rate of assimilation of change and to attain maximum flexibility and adaptability. This is partly achieved through the use of multi-purpose programmable equipment. But to arrive at a thoroughly adaptable process -from variable inputs to segmented markets- a truly flexible type of human organization is required.

b. The need for a participatory framework

Under the new competitive conditions, the old single-task, single-post type of job in which a worker operates under constant supervision according to the instruction manual is no longer adequate. Upskilling and multi-skilling cannot produce the necessary initiative and creativity if framed in the rigid organization that characterized mass production. Skill enhancement needs to be complemented by conditions for participation. This is another area where it is critical to abandon the old "common sense" ideas of traditional best practice. But in this case the mental barriers are reinforced by social and ideological ones.

The increased role of skills in competitiveness involves then two complementary aspects: on the one hand, the mastery of technology -both specific and generic- and, on the other, the ability and the incentives to make creative use of those skills. Bell and Richards have proposed the expression "change generating human capital" in order to indicate the type of effort required and the criteria that both governments and companies should apply for investing in people.

It is also possible to see in this heightened role of human resources a basis for attaining true workplace democracy and a better quality of life. The MIT Commission sees "an unprecedented opportunity in the new technologies for enabling workers at all levels of the firm to master their own work environment". They contrast this with "the technologies for mass-producing standard goods" which "consigned workers to tasks that made few demands on their mental capacities or skills" They consider that "the effective use of the new technology will require people to develop their capabilities for planning judgment, collaboration and the analysis of complex systems". If the opportunity is seized "individuals may experience a new measure of mastery and independence on the job that could well go beyond maximizing productivity and extend to personal and professional satisfaction and well being". Of course, if no social processes develop to make such a possibility a consciously pursued goal, this opportunity could largely be wasted.

c. Education and training at the core or development strategies

The implications of this centrality of human resources for developing country firms and governments are of course many and of great importance. Change generating skills become a key enabling factor both for competitive restructuring and for social equity. This is the central message of the 1990 ECLAC Report, "Changing Production Patterns with Social Equity ". It can also be found in the World Bank Report for 1991 which states that "countries which committed themselves to education and training made great strides in both human development and economic growth".

We would tend to go even further. Education and training have moved from being a complement to the growth processes to becoming the most powerful tool at the core of development strategies. It is increasingly clear that the quality of the potential workforce is becoming the determining factor in the achievement of important development objectives. It affects the ability of local firms to successfully compete internationally and domestically, the possibility of confronting some of the unemployment and marginality problems by developing micro-entrepreneurship on a massive scale to solve part of the unemployment and marginality problems and the capacity to attract a significant amount of foreign investment. "In the dynamic and uncertain environment of technological change, more highly educated workers have a big advantage".

But this understanding has been slow to reach the less advanced countries. It is interesting to note that, according to a worldwide survey conducted by Harvard Business Review, developing country managers put relatively less emphasis on the role of worker skills in determining competitiveness than did their counterparts in the industrialized world. One of the analysts suggests that this might reveal an excessive fixation on technology, which they tended to rate quite high among the success factors.

Yet among developing countries, those that have truly made a leap forward, such as South Korea and Taiwan, stand out for having made extraordinary efforts in human resource development with levels of participation in education comparable to those of developed countries. Additionally, firms in those countries provide significant amounts of in-house training, often extended to their suppliers.

Education and training therefore demand serious strategic attention including a deep reform in the contents, methods and structure of the whole system. Yet it is essential, as both the World Bank and ECLAC Reports recognize, that governments play the key steering role, even as private sector contribution and active participation increase.

The role of government will be especially important in stimulating, enabling and financing a variety of forms of South-South collaboration in education and training. The experience of the European Community in its education and research programmes has demonstrated the enormous value of this kind of "networking" between countries. In section 7 we return to the possible areas for South-South collaboration.

4. Investing In Technological Capability

The growing knowledge intensity of production and competition is often understood narrowly as pressure towards greater efforts in R&D both inside firms and in universities and institutes. But, the discussion so far shows that it is in the combination and interaction of technology, organization and human capital that the increased knowledge content of production is realized. This has immediate consequences for the direction of technological efforts within firms and for national science and technology (S&T) policies. .

a. A new focus on innovation and diffusion

Traditionally S&T policy has focused on strengthening the supply side of the system, especially in the hope of supporting the development of new products and processes. These were expected to lead to breakthroughs for the local firms which might eventually use such results. In doing so, as the OECD-TEP report remarks, these policies "have probably insufficiently paid attention to the capacity of the economic and social system to incorporate such technological changes and transformations". While a supply-side focus was perhaps acceptable up to the recent past, it is becoming increasingly necessary to deal with the complexity of the innovation process from the perspective of the competing firm. This implies enhancing the firm's capability to absorb and generate technical change and raising its ability to use technologies from wherever they are generated. The time thus has come to shift the balance of concern "from R&D to innovation and diffusion policy".

This change of focus is based in part on a fuller understanding of the role that users play in the process of innovation. Rather than being passive receivers of technology, users, it is now acknowledged, play a very active role in the generation of directly applicable technical change. Indeed, as the MIT Comission pointed out, "simultaneous improvement in quality, cost and delivery" as well as "closer links to customers and closer relationships with suppliers" figured prominently among the factors contributing to competitiveness in successful companies.

One consequence of this is for governments to shift from financing innovation outside industry to helping strengthen the processes of technological mastery inside firms and to promoting and facilitating the inter-firm linkages, the exchange of information and all of the other conditions that favor technological interaction between users and producers. These networks of technical collaboration which are woven in a technologically dynamic economy are the core of what has been termed by Lundvall and Freeman the "national system of innovation". The quality of such a system and its degree of specialization are crucial in determining the competitive advantage of a national economy.

A second is for firms to reconceptualize the R&D function. The traditional model of innovation within the firm was linear and sequential. First, people from the research and development department would bring the product or process up to the prototype stage. Then the functions of product engineering would take place and manufacturing and marketing would follow on. This form of compartmentalized effort takes much longer and is much less effective than what is now being called "simultaneous engineering." Researchers, designers, product, process and manufacturing engineers, marketing and salespeople work together in "self-organizing development teams". Work is integrated towards a roughly defined product goal, development phases are simultaneous or have broad overlaps. The result is a much quicker response to markets, a significantly shorter time to innovation and increased learning from interaction.

Another important change in the traditional notions of technology within the firm is a shift in the focus of attention away from the product or process and towards the whole production system, beginning with the tangible and intangible inputs at the beginning of the chain, through the transformation, packaging and distribution process to servicing the product at the client's premises. Every aspect of the production system -and of the administrative procedures as well- is seen as a target for improvement. The overall result is a visible increase in quality,

efficiency and adaptiveness resulting from the additive and systemic effect of minor, medium and major improvements being constantly incorporated at different points in the system.

This incremental attitude to technical change gradually leads to a deeper understanding of the potential and limitations of the technologies in use and points to the direction of more radical change. In short, changes such as this mean that competition is increasingly based on the mastery of technology in an everyday sense; on having production organizations that behave like learning machine.

b. Networks of collaboration

For each firm, the production system to be improved does not end at its own doors. Technical interaction for the purpose of continuous improvement, system upgrading and new product development requires links outside the organization to other companies and institutions. Cooperation with suppliers, for example, takes many forms, from the basic exchange of information, through personnel training to collaborative engineering or R&D and joint investment. Clients are also seen as technical partners. They are the source of valuable information about user needs and about the performance of existing products. Direct interaction with customers has been found to be one of the most effective means of guiding technical change. Finally, networks with competitors, involving partial collaboration, patent agreements, joint research, and multiple arrangements for access to complementary assets or for sharing the high cost of some activities, are also becoming a feature of the modern competitive firm.

Universities and research institutes are among the most valuable suppliers firms can count upon. Their capacity to provide training, information, technical services and research is important. But, for a wide range of reasons there are barriers which prevent a truly intense and fruitful interaction to take place between these institutions and productive units or networks.

c. Networks and the habits of an ISI past

In most developing countries barriers to business collaboration are particularly strong. In relationships between producers and their suppliers there is a long history of confrontation which might need great doses of good will and imagination to overcome.

In order to advance from the mere final assembly stage, most ISI policies included mechanisms to force end product manufacturers to incorporate domestically produced inputs, parts or capital goods, however high the cost or low the quality. The goal of deepening the industrialization process was often achieved but with the unwanted side-effect of creating mistrust and adversarial relations between producers and their suppliers. It is often said in the developed world that firms have to learn to go from "arm's length relations" with suppliers to stable, technology centered, collaborative links. In developing countries the starting point can be better described as "gun-point confrontation". Overcoming these negative attitudes -reforming their institutional embodiments in ministries and industry associations- is a task facing both the private and the public sector on the road to modernization and competitive restructuring.

The experience of technical cooperation with R&D institutes was not very encouraging either. For most countries pursuing an ISI strategy, technology was an input purchased from the foreign originator and put to use by learning established and proven routines. In contrast, the attitude taken by the Japanese and the "catching-up" Asian NICs was to go beyond the mere use of imported technologies according to instructions, and to the creation of a type of organization and a level of technical skill in the workforce that would purposely lead to full mastery and continued improvement of such technologies.

Elsewhere governments in the developing world tried to compensate for the passive attitude towards technology that characterized local industry by building technological capabilities outside firms, establishing research and

development institutes and allocating funds for science and technology to universities. These two worlds remained mainly apart despite constant efforts to build a "bridge" between supply and demand. Yet, as Martin Bell says, "supporting institutions can rarely generate technical change on behalf of industry without significant innovative activity on the part of industrial firms themselves". In other words, a bridge can only be built if there is a support on each side. But for most firms under the typical ISI regime innovation was not a source of profits. Exogenous factors such as the level of protection or subsidies had a much greater impact on profits than technology, productivity or quality of products.

All this led to another shortcoming: a generalized disdain for everyday engineering. Neither firms nor researchers saw incremental innovation as their concern. With a few notable exceptions, the great majority of engineers in developing countries have little experience in the constant improvement of products and processes which is so crucial today. Until recently, engineering graduates were often faced with a stark choice: either the passive operation of foreign technology or research isolated from production.

Competitive restructuring requires activating the links that create a national system of innovation. This depends on establishing a mutually fruitful relationship between industry and technological institutions on new grounds. Such a linkage could begin by the recognition of continuous improvement as an important joint job and of "learning by interacting" as the way to go about it.

Those countries that do not show themselves capable of establishing cooperative links among domestic firms and between these and technical institutes are likely to find it equally difficult to collaborate across borders. The experience developed through collaboration between firms within each country can become an invaluable asset for attempting cooperation between firms from different developing countries and making it successful.

The emphasis here on cooperation for incremental technical change is not intended to diminish the importance of R&D for new products and processes. Rather it is a question of timing in the process of learning to be technologically active. As firms and networks acquire greater mastery of technology in their daily practice, they become more capable of pursuing radical product and process change; as they move to more demanding market segments, they are pushed by competition to do so. This means that strengthening the quality and the capacity of the science and technology infrastructure to prepare for the expected increase in requirements is a wise -and indeed an indispensable- exercise in foresight on the part of both firms and governments. Regional cooperation programs and regional consortia set up to do research about a shared natural resource, product or eco-system is one obvious way to cut the costs for each while increasing the benefits for all. We will return to this below.

5. Market focusing and Strategic Specialization

Having seen from Sections 1 to 4 that competitive production rests on a combination of organization, human capital and technology, we must now look at the ingredient that turns those necessary elements into actual wealth creation. The competitiveness of the firm can only bear fruit through success in the market. This in turn depends on selecting appropriate and realistic market targets. The most creative and efficient firm will fail if its product is unwanted. A company in a developing country trying to compete head-on with a global corporation is not likely to get very far, however much organizational effort it makes. The new approaches discussed above can only be useful for reconversion strategies in developing countries if appropriate market slices are identified by companies, groups of firms or countries and persistently pursued .

a. The collective dimension of specialization

Another aspect of knowledge intensive competition is the relationship between static and dynamic comparative advantages. Whereas the first can serve as an initial platform, it is the accumulation of dynamic advantages that determines competitiveness. Whereas the first can provide a basic cost advantage, only superiority in technology

or managerial competence can guarantee sustained competitiveness as successive innovations change conditions in the market. Modern specialization is a direct consequence of knowledge intensive competition and the greater speed of technical change. When all technological frontiers are moving, remaining in the race will often require concentration on one or very few areas. Firms must specialize in order to focus learning efforts; dispersion can be weakening.

But the firm cannot specialize in isolation. To be successful it needs to rely on interaction with other specialized firms whose capabilities and core competences are complementary to its own and also growing. Equally, it must count upon externalities of all sorts, especially those related to the required types of qualified human resources and of technical services and information. Consequently, strategic decisions about specialization are inevitably collective decisions, especially in countries where resources are too scarce to be squandered.

The question of how these collective decisions are arrived at is another matter. Looking at specific cases it certainly does not seem that they were the result of either pure markets or pure government decision-making. There are countries where geography or history have been decisive, as for instance Iceland's specialization in fishing. In others, institutional arrangements facilitated the emergence of a consensus strategy, such as that between the Japanese private and public sectors under MITI's aegis. The specialization of Silicon Valley in microelectronics appears to have been a spontaneous phenomenon driven by the advantages of agglomeration around the first few firms (Hewlett Packard, Intel, etc.) and some of the best university research laboratories in electronics (in Berkeley and Stanford). Informal networks are crucial to pioneering industries. In Chile, the export specialization in fresh berries and salmon was propelled by the Fundación Chile, a promotional institution set up by ITT, which not only designed the project but organized the initial investment, the transfer of technology and the links with the traders and importers. Both in Italy and in Germany provincial governments have worked together with the local industrial, banking and educational communities to strengthen and modernize the traditional regional speciality, be it engineering, clothing or ceramics. The city of Rochester in the U.S.A., which already had several firms working in optics (Kodak, Xerox, Bausch & Lomb), also arrived at an agreed consensus between the main private and public actors to turn the city into the world center in optics and imaging technology. The new competition seems to involve a high-tech resurgence of lost artisan attitudes as well as a revitalization of the advantages of regional specialization and agglomeration, stressed by Alfred Marshall a hundred years ago.

The routes to specialization are then many and varied. The scale on which it occurs also has a wide range: a city, a province, a small or large geographic region or a countrywide network. A strong focus introduces a bias in the system of innovation, the advantages of which are obvious to all firms connected with that particular focus. That is the main point in Porter's argument about the competitive advantage of nations: the accumulation of experience within each firm, the interaction within specialized networks, the focused research, the concentration of suppliers and services are powerful externalities for enhancing competitiveness.

The free market alone is not likely to lead firms to the sort of long term efforts and investment necessary to remain in dynamic markets. It is precisely to help firms compete better that collective specialization strategies and a consensus on the need to reinforce the system of innovation, are crucial. As Michael Best shows through his analysis of Japan and Northern Italy, "a healthy industrial sector depends upon combining competition with cooperation." Competition ensures constant innovativeness; cooperation ensures long-term competitiveness. The task of the new industrial policy is to administer this paradox.

b. Turning static advantages into dynamic strengths: Rescuing the development value of natural resources

The issue of strategic specialization brings us to the question of comparative advantages and whether they are back at the center or out of the picture as two extreme positions in the debate would hold. We suggest that in the new circumstances both positions are right. Alone, comparative advantages such as natural resources and other

static conditions are no longer a basis for capturing and maintaining market share. But they can become central again and crucially important to development strategies, when they are used as a platform on which to build dynamic advantages.

The new technologies are capable of upgrading and modernizing any economic activity from mining, fishing and agriculture, through all branches of manufacturing to finance, distribution and other services. The consequence of this for developing nations and for the firms within them is that the range of economic activities on which to base a process of dynamic growth has broadened. All sectors are capable of becoming technology-intensive. For a long time "development" was almost synonymous with "industrialization." Manufacturing was seen as the sole generator of technology and progress, primary activities seemed to stagnate and the goal of almost every developing country was to diversify away from natural resources. In the present context, these notions must be revised. The time has come to seriously reconsider resource-based, knowledge-intensive development.

Succeeding in a strategy of turning simple static advantages into truly dynamic and competitive ones will not be easy. It involves intense effort and concentration of local technological capabilities in acquiring and mastering production technology. This demands equivalent and simultaneous efforts in organization, training and skills, supplier development, continuous improvement of products and processes, effective marketing and technical relations with users. It may also require the establishment of some sort of institutional mechanism to bring together all actors in the system, from initial inputs to markets, in order to develop a consensus strategy and agree on targets and forms of cooperation. The objective would be to become as good at exploiting the potential of natural resources as the Japanese are at electronics.

Examples of success in this sort of strategy are the Colombians with fresh flower exports, the Chileans with fresh fruit and the Malaysians in palm products and rubber. All have made intensive efforts at mastering the complexity of handling fresh produce for long distance highly demanding markets. Technology, skills and organization are constantly being upgraded in agricultural production as well as in post-crop handling, packaging, distributing and marketing. The latter have sometimes required audacious business initiatives. In the case of Colombian flower exports, the resistance of U.S. growers was met by the Colombian Association of Flower Exporters through a coalition with U.S. associations of importers, retailers and supermarkets to resist import quotas. At the same time the Colombians established an alliance with the affected rose growers for a joint strategy to promote an overall increase in the sale of roses.

As concerns diversification, there can be a clear advantage in building around natural resources: upstream, to specialized inputs, capital goods and services; downstream, to greater value added and specialized products for "niche" markets. The accumulated technical expertise in the primary product makes for competent users capable of fruitful interaction with suppliers and clients. The growing synergy that can result from these networks of technical interaction can benefits all concerned. Suppliers have demanding customers to specify products and services together with a trial bed for testing and improving before eventual export efforts. Downstream producers can count on the experience of primary producers, with whom they also share an interest in conducting joint research. Finally, the primary producers benefit from the bias of the local system of innovation around their needs and markets. The network thus becomes the basis for a "positive-sum game" among its players.

The idea of following a path of advantage enhancement does not exclude being bold about new options. When building from existing advantages one can identify possibilities for effectively jumping into frontier technology. Biotechnology, new materials and information technology all have vast applicability and can be used as an important additional source of competitiveness in the development of natural resources. Biotechnology is an obvious tool for building dynamic advantages in agricultural activities. It is also useful for managing waste in mineral processing and even as a mining process, through bacterial leaching. The point being made here is precisely that new hard and soft technologies are the tools available for modernizing whatever the chosen

economic activity. It just makes sense to choose those activities where there are static advantages and accumulated experience as a starting point.

c. Market segment and technology focus

Previous experience can become the basis for the development of a set of "core competences" in a well specified direction that can lead to dynamic advantages capable of increasing and enduring through time. This is all the more important today when firms and countries are facing much more segmented markets, undergoing frequent technical change. To capture a market position and retain it, firms have to be able to concentrate their continuous improvement efforts in a precisely targeted market slice or range.

It is often said that the new competition involves an increasing number of non-price factors such as quality, reliability, service, timely delivery, flexible response and user-adaptedness. But these features figure in different combinations and with different prominence depending on the chosen market segment. In a specialized "niche", quality and user-adaptedness are much more important than price; for a high volume standard product, timely delivery and price are crucial for competition whereas user-adaptedness and service might not even be pertinent in many cases.

FIGURE 6

DIFFERENT COMPETITIVE AND TECHNOLOGICAL ACCENT ACCORDING TO MARKET SEGMENT

	ECONOMIES OF SCALE	ECONOMIES OF SCOPE	ECONOMIES OF SPECIALIZATION
TYPE OF MARKET SEGMENT	HIGH VOLUME	MULTI-PRODUCT RANGE	USER-ADAPTED "NICHE"
COMPETITIVE FEATURES			
PRICE	*****	****	*
QUALITY	***	****	*****
DELIVERY	****	***	***
SERVICE	*	**	*****
FLEXIBILITY		*****	****
KEY AREA FOR MASTERY OF TECHNOLOGY	PROCESS TECHNOLOGY	ORGANIZATIONAL TECHNOLOGY	PRODUCT TECHNOLOGY

Such variation in the features demanded in each segment imply differences in emphasis for the building of technological capabilities. Figure 6 shows a summary view of these three very rough types of market targets and their characteristics for competitive strengths and technology focus.

Targeting the high bulk standard segments of the market for any product (ie. being a so-called "low cost producer") demands a concentration of effort on the mastery of process technology with a particular emphasis on reliability and cost reduction through the elimination of waste in raw materials, capital, idle inventories, flawed products, by-products, bureaucracy or time.

At the other extreme, the narrow niche markets require the mastery of product technology on the basis of highly specialized and constantly upgraded knowledge and skills, plus very close interaction with the users.

An option located towards the middle part of the spectrum is seeking economies of scope through the multi-product firm operating in the medium volume segments. These, depending on the industry and specific chosen range can be characterized by higher or lower rates of change in models or technical specifications. Competing

in this part of the market demands high flexibility and quick response to variations in demand in terms of product mix (in volume) and product change (in specifications). Handling product variety in this way, which involves avoiding idle capacity through responding "on line" to demand variations in a range of segments, requires special efforts in organizational ("soft") technology.

Thus, the spectrum of options has become wider for almost all product ranges. This demands strategic decisions on the part of each producer. The best choice of location on the market spectrum will depend on many factors including static advantages, the sort of equipment already in place, the level and quality of accumulated knowledge and experience assets, the type of existing or potential market access, etc. There is also the possibility of following a gradual learning path from easier to more demanding market segments.

Whatever the choice, remaining competitive and profitable in fast changing segmented markets demands constant effort. No market position is safe without continuous upgrading of technological capabilities and monitoring of the market. This suggests that even the largest firms cannot remain in isolation. The need to build or join networks, create consortia for research or other purposes, to link up with partners for joint training, marketing, product improvement or other costly activities, to help suppliers and to interact with clients is inherent in the new conditions of competition. Contiguity becomes an asset in developing such network.

d. Networks and territorial proximity

Proximity is another element to be taken into account when targeting markets and selecting a specialization. In recent times, developing countries that are geographically closer to the most advanced ones have become the preferred location for foreign investment in export processing or in lower cost manufacturing. East Asian countries are being incorporated in successive concentric waves into the Japanese network. Mexico's contiguity with the U.S. favors it as parts producer for American companies; it also becomes an advantageous location for Japanese or European companies exporting into the U.S. market. So the capacity to attract investment as part of global networks is affected by proximity to core producers or final markets.

But this aspect of the proximity issue is in a sense the most traditional. In terms of the new paradigm, knowledge-intensive competition in goods and services fosters frequent interaction and direct human contact in formal and informal networks.

Although the type of interaction varies in accordance with the market segment envisaged, being near certain services or suppliers can in some cases be more important than being close to final markets. So, the territorial proximity issue needs to be taken into consideration when targeting markets.

Direct interaction between final producers and suppliers of intermediate goods or services is not so important when the final product is standardized or when the input in question is a basic sort of material. But, technical change is increasingly affecting the range of what is considered to be standardized and the practice of continuous improvement creates the need for direct human contact for technical networking. An organizational technique such as "just-in-time", for instance, tends to favor a strong long-term relationship with a small number of chosen suppliers because it depends upon very quick adaptability and response of the whole chain to changes in demand. This makes physical proximity of suppliers almost indispensable. Equally, "total quality" production implies technical interaction with parts producers in order for the whole system to move towards zero defects. This direct contact often involves "supplier development" programs where the core firm invests in improving the technical capacity of the chosen suppliers. In the case of very specialized suppliers, direct user-producer links increase the capacity on both sides of the relationship.

This has implications for the way to approach specialization. A bid to take part in global networks as parts suppliers might be difficult for countries geographically far from the core producer. Next to labor or other cost

advantages, attracting this sort of investment would also require great ease of communication and movement of people as well as fluid movement of goods. Physical distance, the quality of the transport and telecommunications infrastructure and the reliability of the services all count towards the competitiveness of suppliers, thus determining the viability of that option.

When the core of the supplier network is local, as when specializing in a natural resource, the quality of the domestically provided goods and services plays an important part in the competitiveness of the main exporters. This is the case when the large oil or mineral companies, the agricultural firms or groups of firms in the developing country, become the core users for supplier networks. The question then is how to attract foreign and local suppliers to give effective support to the core activity. For the local firms, dynamic interaction with the core producers and proven competence in providing the required goods and services may offer a protection equivalent to the old tariff barriers. Fostering the multiplication of these networks as well as the establishment of universities, research centers, consultancy and other technical services is part of the process of rescuing the development value of natural resources. Another aspect of this process is connecting up with foreign sources of information and technology as well as creating conditions to attract investment from highly specialized suppliers. A virtuous circle needs to be unleashed: the stronger the local system of innovation the more attractive it becomes for others, thus reinforcing it further.

A second type of proximity, which overlaps partially with the first, is between producers and final users. In the new competition user-adaptedness is an important characteristic of successful strategies. Locating next to particular key users or in the midst of a large group of users is an advantage in cases where intense interaction with clients is a key element in capturing or keeping markets.

This is obviously the case with customized services but also applies in a range of other cases: when technology is moving very fast and users are highly sophisticated (special materials for the semiconductor industry, for instance); when the main users are themselves very active in developing the technologies they need (as tends to happen with fine chemicals); where environmental factors are essential in determining product or service characteristics (for example, a pest-control system for a tropical crop); where market competition is very fierce in terms of quality, adaptability and functionality (specialized software, for instance) or whenever technical information for development, adaptation and upgrading are a key element in customer satisfaction. In many cases this can be done through a commercial network with technical services but in others direct contact with production engineering, research or design might be necessary.

This again has mixed consequences for specialization strategies in the developing world. At one extreme, in the high tech sophisticated "niches" there is considerable restriction for successful entry, given that the immense majority of sophisticated users are in the advanced countries. So great care must be exercised when targeting such niches. One obvious recommendation, when aspiring to relatively high-tech products, is to target the needs of the local resource-based industries, when these are -or are trying to become- technologically dynamic and competitive. Linking up with the Venezuelan oil industry, for instance, there is growing expertise in digital image processing services, in certain catalysts and in special chemically treated perforation muds. Analogous examples can probably be found in every country. Other options may involve partners in the advanced countries or technical service "outposts" perhaps in cooperation with other firms.

In contrast to the restrictions encountered when targeting high tech users, the range of opportunities widens wherever the customizing or adaptation is related to environmental, cultural or other territorial factors. This is then the case whenever the local market is the initial target and its peculiarities define the "niche". In the case of biotechnology, for instance, Alyson Warhurst has pointed out the difference between closed and open processes. The former take place in an industrial plant or laboratory; the open processes must be carried out in a particular territory and be specific to it. Bacterial leaching as a mining process; some depolluting systems; natural

fertilizers, pest control systems, vaccines for local animal or human diseases and plant or animal varieties adapted to thrive in specific conditions are some examples of open processes where interaction with the users in the territory allows the development of specialized products. Even in consumer-oriented industries, such as the automobile, global companies locate some of their engineering design centers with a view to adapting to the cultural or climatic requirements of a particular region. This is the policy of Volkswagen in Europe and at least one Japanese company has declared its intention to set up design centers in several regions of the world to adapt their product to the market. Institutional differences can also be a source of advantages. The electronic banking systems developed in Brazil adapt to the specific type of continental-size, country-wide network, peculiar to Brazilian banks. This gives them an edge in the domestic market and has helped their exports to other countries with similar banking structures.

Thus, the capacity of the new technologies to adapt to user-needs gives territorial specificity a more important role to play in defining market segments. Fostering interaction between competent producers and final users to identify and develop such segments is an option to consider when developing patterns of specialization.

6. Internal Constraints and Windows of Opportunity

For a large proportion of developing country firms and governments the idea of striving to become internationally competitive marks a fundamental change in attitude. For decades one of the roles of the State in many countries has been to take compensatory measures for what was understood to be the inevitable lack of competitiveness of firms in their territory. Yet it seems an inescapable fact that the world is going towards open frontiers (whether within trading blocs or globally). To grow and develop, firms and countries will have to become capable of successfully competing in a much wider and much more demanding environment.

The transformation towards knowledge intensive production and markets is proceeding at different speeds in the various advanced countries and in the "catching-up" NICs. Within most of those countries, it is still only the more dynamic firms and industries that have adopted the new practices. Yet the competitive strength they display in the market makes it likely that technical dynamism and networking will become not only best practice but the normal behavior of well managed firms everywhere.

a. Obstacles to surmount and opportunities to pursue

Among the developing countries there is a wide variation in terms of the level of awareness of these changing conditions and in the extent to which they are being taken on board in practical terms in strategies and policies. There are, of course, many obstacles in the way of widespread adoption of innovation oriented practices. Some are similar to those faced by firms in the more advanced countries, others are due to underdevelopment itself. But perhaps some of the more intractable ones are the institutional and ideological barriers inherited from the once effective ISI model, including powerful vested interests in the old way of doing things.

The period of industrializing by sheltering the domestic market left a valuable legacy of investment in plant and equipment, development of physical infrastructure, managerial and worker skills and experience, a higher level of education as well as varying amounts of engineering and research capabilities and facilities. This is the platform from which to launch modernization and reconversion efforts.

But for most countries this positive inheritance carries also a heavy burden. The typical ISI framework, excluding the few cases such as Korea that used it as preparation for competitive exports, remained inward oriented and allowed firms to grow with a particularly passive approach to technology and markets. The combination of high tariff protection, various forms of subsidy and restrictions to competition made it possible for firms to be highly profitable with little or no effort to increase productivity or quality and with almost no risk of losing what were in fact captive local markets. Even the export promotion policies of later stages carried large subsidies to offset the lower local productivity.

This means that whatever the level of industrialization attained through an ISI strategy, each country will have to overcome two different sets of weaknesses if it is to become competitive. On the one hand it has to confront changes similar to those identified for U.S. industry by the MIT Commission; in other words, the technologies, the managerial practices, the know-how acquired through traditional technology transfer processes are now as partially obsolete as they are in their countries of origin and must be upgraded and modernized. Additionally developing country firms need to surmount dependency on state protection and subsidies while they become active in the mastery of technology and in market competition; in other words, firms must endogenize their sources of profitability.

Ironically, the process of weaning firms away from dependency on the state is likely to require support from government. The type of changes to be effected imply access to information, to technical services, training, consultancy and other inputs which must be available in the local environment if they are not to imply excessive expenses. They could also involve transition costs that many firms otherwise capable of surviving might not be able to afford on their own.

In sum, while there is no denying that the changes currently underway have mixed consequences for development prospects, This paper has tried to emphasize some of the positive routes opened for development policies under these new conditions. These include:

1. The possibility of optimizing the use of scarce financial resources by reconverting existing plant through reorganization and by favoring modular growth which reduces the need for new investment in designing new plants;
2. The potential for reaping high returns from investment in change-generating human capital, while also contributing to greater workplace democracy and social equity;
3. The advantages that can be created by strengthening the national system of innovation, starting with efforts to bring together the technological capabilities existing outside and inside the productive system to concentrate on incremental innovation and mastery of the technologies already in use;
4. The possibility of rescuing the development value of natural resources by using these resources as a platform to build competitive advantages and as the core of innovative networks for upstream and downstream spin-offs; and,
5. In general, the opening up of a growing range of options for specialization stemming from the all-pervasiveness of new technologies, the increasing segmentation of markets and the growth of global networks. This wide spectrum allows each firm, group of firms or country to home in on those market targets that provide an optimal learning route and make the best use of its particular combination of conditions and competitive asset.

b. Some avenues for South-South cooperation

As technology and competitiveness become prominent among the tools and the goals of development strategies within countries, the objects of intercountry agreements will naturally follow along the same route. Even free trade areas, such as the one recently established by the countries of the Andean Pact, now go beyond looking for enlarged markets and explicitly state that a "modern and dynamic insertion in the world economy, reinforcing the competitiveness of Andean economies", is one of the main goals. Given the demands of the new competition, we may be entering, as Lynn Mytelka suggests, a phase of innovation centered cooperation.

In fact, collaborative links between firms, regions and countries are likely to multiply rapidly in all directions: North-North, North-South, East-West, South-South, etc. The more prominent of these will naturally be the supranational framework agreements, such as the Free Trade "Blocs". The other innumerable arrangements for partnering and cooperation between firms across borders and in wide international networks or the local initiatives among neighboring or similar regions will be less visible yet their impact in the long term will perhaps be the most significant. These are likely to be established for specific purposes, by the direct actors, in the context of common or complementary interests and strategies. Here we shall refer to some possible South-South collaboration initiatives to facilitate the processes of modernization.

1.- If enough countries undertake the reorganization route to modernization outlined above, regional banks, such as the Inter-American Developing Bank or the CAF and eventually the World Bank, coud be convinced to open lines of credit to finance this type of activity in each country and to support public, private or mixed organizations in setting up regional training programs and mechanisms for sharing experience and information.

2.- Investment in human resources could also benefit from cooperation between neighboring countries particularly by sharing the costs of training programs and of permanent centers in certain technologies; sharing experiences and expertise in relation to the educational reform; bringing international specialists for joint courses in areas of common interest; retraining teachers; collectively funding educational material such as video programs, satellite broadcast and computer teaching aids, etc.; and developing new textbooks between countries with a common language.

3.- As regards the system of innovations, this can develop on an intercountry or regional scale where there are shared eco-systems (Amazon basin, High Andes, African deserts, etc.) or types of natural resources, where there is specialization in a similar sector or other commonalities such as language, culture, climate. The forms such cooperation might take include networks of technical interaction and various arrangements for joint training, marketing or exports. In regional free trade zones, as trade, communications and movement of people, goods and services increase, possibilities are likely to open for the creation of technical cooperation networks between suppliers, clients and competitors from neighboring countries. This can be facilitated through financial or institutional agreements.

4.- Countries that take up the idea of knowledge intensive natural resource development can explore at least three lines of South-South cooperation: extending their supplier networks by profiting from expertise available in neighboring countries; joining other producers of the same resource to establish a combination of collaboration (for research, information, training, etc.) with competition in final markets; organizing with all producers of the same resource to negotiate with consumers and establish positive-sum type rules against violent price fluctuations and other aspects of common interest.

5.- Many "intercountry" linkages are likely to develop not between countries as such, but between nearby cities or neighboring regions. As turf barriers come down, frontiers become transparent and awareness of shared resources and common interest can grow in border areas. Sharing a port, co-financing a portion of the telecommunications network or other special service, improving or building roads or railways can be joint projects to improve the infrastructure on both sides of a frontier. The same can be said about the technical infrastructure: training services, research centers, testing laboratories, are some of many possible shared projects across borders. Creating an appropriate institutional and legal framework to allow and indeed foster this sort of localized interaction is a task worth pursuing.

6.- Finally, much collaborations will take place between firms from different countries. If firms become the leading actors on the national scene, it is natural to expect this phenomenon to overflow into international cooperation. All actions that can remove obstacles and create a favorable context for such partnerships are worth undertaking.

These collaborative processes cannot be planned in the traditional manner nor will they occur by signing declarations. The actors must be involved, facilitating mechanisms will be better if they are simple and unbureaucratic but, most of all, cooperation is about specific actors joining to perform specific tasks for mutually beneficial results. Much imagination will be needed on the part of policy makers to avoid old style planning and to design schemes that stimulate and support the creativity of the economic actors themselves.

What has been argued throughout is that the present transition involves an upheaval in traditional common sense. This paper has tried to spell out a few of the main elements of that new common sense and hence to set up some guideposts for viable managerial and institutional creativity. Our intention has been to paint the general background of change on which to locate the possible roles and purposes of intercountry cooperation. Thus, of necessity the paper has been exploratory and suggestive rather than conclusive or normative. In the uncertain

and turbulent world of today much experimenting will take place before a clear difference between successful and unsuccessful strategies can be drawn. There is no doubt, however, that an understanding of the nature of the changes taking place in technology, management and markets is a powerful tool in enhancing the likelihood of achieving positive results on the part of firms, groups of firms, governments or regional organizations.

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