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ABSTRACT

Two things are required to bridge the technology gap between rich and poor countries that has resulted from the scientific and technological revolution: (1) a national development strategy that places a high priority on studies of global technological strategies for each sector of the economy; and (2) very high level educational institutions equipped to create scientists, engineers, and technologists with the creative capacity to adapt, improve, and innovate and the social conscience to evaluate technology's effects beyond its pure economic benefits. Available statistics on the funding of research and development in developed and developing countries throughout the world confirm the importance of establishing mechanisms to promote common social interests in research and education financing. Enabling developing countries to bridge the technology gap requires the establishment of new relationships among research, technological development, and high-level human resources training. Educational, science, and technology policies must be bound strategically to economic and social development plans. Research and teaching centers alike have critical roles to play in translating fundamental research results into improvements in industrial production that will in turn improve individuals' social welfare. Technology must be understood not simply as "applied science" but as "the science of productive work." (Contains 27 references.) (MN)

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Abundance and Scarcity: A Prospect for Emancipation using Educational Institutions where Research and Development are Change Agents

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The scientific and technological revolution produced a gap among the countries that produce and export raw materials, and those which produce and export manufactured products. Throughout the eighties, Schurrman (1993) found this to be the number one reason for the impasse of development theories as "developing countries were unlikely to be able to bridge that gap whatever strategy they would follow" (p. 10). The countries that have attempted to bridge this gap, without creating or strengthening their own educational systems, scientific systems, and technological systems to the level of this new industrial revolution have had to pay a high price with "indebted industrialization" (Carnegie Council Case Studies, 19**, p. 4). The effects of this gap have been studied profoundly (Schurrman, 1993, P. 10; Korten & Klauss, 1984, p. 22).

A partial "modernization" has been accomplished for some countries, though at a cost of indebtedness and fabulous decapitalization. "The gap between the rich and the poor countries continues to grow. In 1990 the richest 20 per cent of the world's countries had incomes 60 times greater than those of the poorest 20 per cent of the world's countries; in 1960 the ratio was 30:1" (Corbridge, 1993, p. 124). If the strict international trade control that imposes barriers on the products of the third world is added to this, along with the the new phenomenon of strict control of technological and scientific protectionism from the highly industrialized countries, then you can have a first hand account of the situation that developing countries face.

To develop a desirable technological strategy that can replace "political means such as building, maintaining, choosing, acting, and reinforcing [the]technological politics [for these countries, there is a need to transform] orders and adapt objects to align with technical structures" (Winner, 1992, p. 237). Three conditions are required for the strategy: (a) a deeper knowledge than what already exists in the world and of how it can be used; (b) the creative capacity to adapt, improve, or innovate; and (c) the social conscience to evaluate the effects of technology beyond the pure economic benefits. oooo

These conditions can be achieved through two associated components: (a) a national development planning strategy that places a high priority on the studies of global technological strategies, for each sector; and (b) very high level educational institutions that create scientists, engineers and technologists within the three indicated conditions. The systems approach here is similar to that of Elull's (1980) description where the features of a system consist of a set of elements that interact, combine more readily with other aspects in the system rather than outside it,that is constantly changing, interacts with other systems and that contains feedback structures that allow the process to adapt to qualitative data (p. 76)

The technical development must help countries to escape their crisis and to define a new development model, to prove Elull's (1964) objectionable assertation "that man participates less and less actively in technical creation [which reduces him] to the level of a catalyst" can be seen positively, but this will only be possible if the country's research and development are immersed in a democratic discussion about what they want as a country, taking into account their culture and their society (p. 135). Because culture itself, "has a critical impact on technology" (Wenk, 1989, p. 28).

The intellectual resources, especially the scientific research and technological innovation capacities should be the first weapons of development. Failure to do so would allow the society to reach the limits of its innovation, as Barrett (1979) explains "a highly technical civilization that sought to run itself on its accumulated techniques could not escape the contingencies of decision and creativity that are needed to keep the machine going" (p. xix) A wealth of such information is naturally cultivated, which implies among other things, a growing and supported national educational system effort, to integrate in its programs and in the training of developers, the results and the advances of contemporary science.

Science and technology are the origin of "know-how" and it is common place to assert that science is the base of industrial development and science must be the prime mover (Gendron, 19**, p. 17). "Historically, however, technology is older than science in its modern guise" (Ihde, 19**, p. xix). Science and modern technology have had a deep influence in economies, in societies, and in international relations. We are at the verge of an incredible scientific advance and an uncontainable technological development. Science moves technology and this, at the same time, contributes to spiraling scientific developments (Winner, 1992, p. 46, 47).

The development strategy

The spectacular advances in the areas of telecommunications, computers, new materials, the conquest of the space, the energy crisis, the microelectronics and biotechnology are surprising. This last discipline, through the techniques of the genetic engineering, is transporting the world to the threshold of a new agricultural revolution. International experts recognize that the principal beneficiaries of this revolution could be the countries that are in the development process: food importers, if "reverse adaptation" of those countries infrastructures can adopt the necessary structural changes (Winner, 1992, p. 238).

This last reflection concerned the aspect of agriculture and is equally valid for the various engineering specialties, but particularly those of advanced countries that have developed the current standards in technological and scientific development, they are presently considered strategic, in order to preserve the countries leadership roles in the future: in telecommunications, computation (equipment and programs, computer aided design), materials, the aerospace technologies, energy and biotechnology.

Science and Technology

Development consists of more than technical problems, it is represented by industrialism, modernism, development, social and political change (Winner, 1992, p. 46). While in Europe some years ago, I was with some friends viewing the magnificent Cathedral of Chartres (centuries XII and XIII), when one of them mentioned: "These cathedrals are the same as many other structures of that time, and were built before Isaac Newton (1642-1727) had been born, and even before one of his more important contributions: the Newtonian mechanics . . . you think t that hese structures were based on science. . then you should be familiar with the extraordinary works of Homo Faber, for humility must have been the number one norm for man". This discussion was raised about whether science was the first to be developed and then afterwards technology. Ihde (19**) suggests that the distinction between science and technology "phenomenon is better understood as a technology-science realtion. Technology becomes the origin or 'cause' of science" (p. xxiv).

Perhaps one of the reasons technology is despised by some science philosophers can be found in the following aphorism: the scientist observes nature and tries explaining it such as he sees it, the engineers and the technologists observe the world and its character and try creating what they see as lacking. The idea behind the saying, can help us explain why philosophers have put so much attention and dedication to science and not to technology or engineering. For many centuries, science has been recognized as a form of thought, it has its own methods and propositions from which to acquire knowledge and truth. Ihde (19**) expands on this reason in detail and states the "philosophy usually concerns itself more as a type of 'conceptual' engineering than as a 'material' engineering" (p. xix). These methods and inherent suppositions, have presented obvious problems and interesting questions to philosophers.

What are the scientific implications for the knowledge theory (epistemology), what is the nature of scientific explanation and how does it differ from the others, such as sociological or historical explanations? What is the logical status of the scientific test and of scientific laws? Are they the scientific propositions that have been proven factual and tested or are they solely false expressions? Etc., etc.

The aphorism also would help us explain why the philosophers of science rarely use examples of scientific activity when faced with problems of philosophical moral or ethics. If science has to deal only with the explanations of nature -to explain what exists- then ethical problems are not brought to the surface.

Ethics

In spite of all this, scientists are more involved with ethical aspects all the time, since science is increasingly intimately bound to engineering and to technology, whose reason of being is to provide or create what nature lacks, or of transforming nature which in turn transforms the way we live.

Engineering, similar to the medical sciences, currently and above all through genetic engineering, has important relationships to ethical problem. This is due to the fact that engineering is substantially the application of scientific knowledge and has obvious social consequences that involve human securities.

Technology collectively provides enough examples of ethical problems, if by collective ethics we understand the moral posture adopted by society. For example; How to view a society that restores the maintenance of natural resources for its future generations, its effects on the environment, the valuing of individual and collective welfare, and the valuing of collective humanity? How do you formalize scientific, technological, and economic policies that sponsor equitable development, policies that permit evenhanded bridges across the gaps of technological and scientific development that have been produced among the known peripheral and central countries, like those of the North and South America, among the developed and the underdeveloped countries or those that are still in the development process?

Development

In societies, Latin American in particular , the preoccupation with establishing scientific and technological development programs explicitly and public education improvements could be placed in the seventies (Creation of the Conacyt in Mexico in 1970s). José Joaquín Brunner in his work "Human Resources for Research in Latin America", says: "Considering only the short period, meaning among the 1970s and 1980s, it can be verified how the situations of science and technological activities rapidly and profoundly changed Latin America. The engineers and scientific staff devoted to the labors of Research and Development (R and D) happened as world participation totaled from 1. 5% to 2. 4%. . . the expenses intended for this effect increased from 0. 8% to 1. 8% of the world total. . . the number of scientists and engineers increased from 38, 000 to 91, 000, incrementally their proportion of millions of inhabitants from 136 to 253. . .

The R and D expenses went from representing 0. 30% of the regional GNP to representing 0. 49%. . . ". However an imbalance currently exists among strengths in qualified staff and research and technological development (RTD) expenses among some under-developed countries and developed countries, as shown in the following comparative data examples between Mexico, Japan, and the United States of America.

* INDICATOR	MEXICO	Japan	USA
* Population	1		3
* GDP	1		30
* GDP/ capita	1		11
*% GDP to RTD	1		9
* Government RTD spending	1		100
* Private RTD spending	1		750
* Total expense in RTD	1		250
* # of scientists and engineers	1		100

The data show the importance of establishing mechanisms to promote common social interests, in research and education financing, in particular in reinforcing the training of engineers. Naciri (19**) states that the "existance or not of a strong [social] community, well structured and enjoying basic autonomy and decision power at the local level, has a profound influence" on the urban evolution itself (Naciri, 19**, p. 160). The role of economic growth should be a means, and not an ends.

Knowledge

It could be said that those who insisted on knowledge as playing a fundamental role in productivity development were early pioneers, an elite cognizant of the mega-tendency that would follow with world development. These pioneers, like Harman, in his essay Key Choices (1984), states that "Education, everyone agrees, is central to development. But what kind of education?" (Korten & Klauss, 1984, p p.31). Boulding (1984) states in his essay The Economics of the Coming Spaceship Earth that "knowledge or information is by far the most important...key to human development of all kinds" (Korten & Klauss, 1984, p. 66). As such, Long & Villareal (1993) focused onthis one important field of development in their essay Exploring Development Interfaces, "one important field of application, namely that centering on the process of knowledge acquisition, utilization and transformation" (Schuurmanl, 1993, p. 142). Knowledge undoubtedly influenced many aspects of remote daily life in some countries, yet the important ones such as, nuclear energy, the spatial conquest, the developments of new materials, and most recently, modern molecular biology, etc. are also factors. This constant development occurs over time, each generation "requires that the basis for the knowledge be cobstantly refreshed" (Korten & Klauss, 1984, p. 88).

But for daily productivity knowledge is not so evident as in some advanced countries . Elull (1980) advised that knowledge should be practical for the worker, "the important thing is to prepare them for a profession (i.e., the technologies of some branch)" (p. 312). In the United States, for example, this has resulted in a profoundly successful system of worker organizations that required and produced workers that were qualified in very limited capacities. This is now considered to be the fundamental cause for the loss of that country's productive advantage as compared to Japan or Germany. The rapidity, but above all, the magnitude with which knowledgeable predictions have been fulfilled in material productivity, were sometimes termed as "science-fiction, " are now within 10 years of our reach, and among life's daily desires we can add many of them to the daily basic needs list; for example, the improvement of agricultural production through genetic engineering (plants, cross-breeding with greater productivity, and resistance to a great variety of parameters: salinity, pesticides, temperatures, etc.), or new medicines. We have to recognize that about 50% of the population of some countries is still found in poverished conditions, and in several of them the percentage that reaches the denomination of "extreme poverty" increases when including the absence of drainage, running water, electricity and others that are minimally satisfied by definition, yet there are the impressive developments in microelectronics, automation, computer control processes, recombinant DNA techniques and their multiple applications, robotics applications, artificial intelligence, new materials, flexible manufacturing methods, and the disappearance of boundaries via the communications satellite. Elull (1980) concluded that "technology and desire are perfectly matched. In our society, the exhaultation of desire can only advance via technology" (p. 317). We need to understand these developments and value the structural changes that occur in their place in daily life: in productivity, in consumption, in work, and in art, in dissemination, and in policy.

The "lost decade" of the eighties indicates that neither the export of raw materials nor cheap labor will solve the development problems of some countries (World Bank, 1990, p. iii; Carnegie Council Case Studies, 19**, p. 13). The new trends of world development: the globalization of the economy; the creation of new spaces for world trade; the push to form medium and small scale industries that are integrated and subordinated to rhythm requirements; times, cost, and production quality similar to large companies yet in very different geographical locations; all types of interventions on the cultural identities of peoples, and in particular, the determinant frequency of scientific knowledge and technological developments on productivity, consumption, and not only economic but political and cultural exchanges as well are the ones which can not be removed from existence.

We run the risk of creating new and accelerated dynamics for distancing countries from one another, within each other, and worse yet, we run the risk of being removed from the global economy.

Prior to this situation, we should reiterate the need to defend the securities that guide the legitimate ambition of building a country's own future. Sutton (1988) in his essay, Development Ideology: Its Emergence and Decline, supports this view and states that "countries should decide for themselves what kind of development to have" (Sutton, 1988, p. 53). The preservation of a countries self determinism and its cultural identity, the search for a quality of life in all dimensions, and to respect the environment., the internal democratization, the transformation of the production infrastructures to achieve a growth that is equitable and just.

Thus, the construction of a future like this, will only be achieved with a social determination that work conditions can generate , and which could elevate the country to a greater quality of life. Recent history assures us that these processes are those which involve the intense use of increasingly complex knowledge (Lewis, 1988).

Roles of Research and Teaching

To understand the role that research centers and teaching centers will have to play in their areas of expertise, four global considerations seem to me to be indispensable in facing these new social challenges: (a) to clearly assimilate the nature of the relationships that the experiences of developed countries with science and technology; (b) use contributions from social research on the nature of the relationships among the academic world and the production world, in order to be free of unobtainable objectives being imposed on the country; (c) recover the experiences from thirty years of support to research and technological development that permits us to identify those levels of institutional organizations that were ignored; (d) and finally, it seems indispensable to me to identify who will make these changes possible. I will refer to these in the order of the prior indicated points:

It is common place, at least to some extent, to accept that science alone can not fulfill the inedible purpose of important contributions to national social and economic progress where it is establish as a high-priority development strategy.

That activity has to be translated into technological applications, into improvements to production processes, into better services, in short: into greater social welfare. It has to translate technological matters into innovation and local development.

The topic of innovation is of greater transcendence and reflecting on it would surpass the idea, that is common to our hearts, that innovation is the initial step of a mechanical and linear movement, in one sense, it comes from fundamental research to industrial production through the simple mechanical means of diffusion.

Innovation is considered as a cumulative and interactive process today. Its interactive character is the result of the joining of several factors.

The consumers of industrialized countries are, in terms of quality, price and delivery times, increasingly demanding. Science and technology were considered relatively distinct in the past, now they are considered interdependent. Technological development requires multiple and complex "know how". Thus, the notion of the interrelationship is of decisive importance, and as such, it is notable to recognize that the innovative companies are those that know how to manage those interactions, that make it act in unison, that make and offer available technology in response to the aspirations of the market quickly.

Many reasons explain the cumulative character of innovation. On the one hand, technology is supported day to day with scientific advances, and science proceeds with the progress of accumulated knowledge. Like wise, to dominate the growing complexity of technological systems, industrial companies should develop technical know-how in long range learning process. This effect of accumulating knowledge and qualifications (experience) drives the mechanisms of highly profitable return in investments in research and development, and contribute to what can be called the technological background of the company. In the course of technological development there exist a point where the experiences of its effects is interactively reinforced through its acquisition at each stage , this permits an accumulation in competency levels and of "know-how" innovators. The solution of technical problems is only part of development, participatory democracy fuels development, without it, only the the elite will benefit from the education and they are not concerned with the masses (Sutton, 1988, p. 54-57). From here, the importance of preserving the participation level of personnel that contribute to the accumulation of knowledge and experience is the heart of companies and institutions, this can be accomplished through adequate politics (Woodcock, 19**, p. 12, 22-25). The examples of Japan and some European countries are lessons to all.

It is necessary to advance towards a new technological concept.

Technology can not simply be understood as "applied science", but, as says Ruy Range, "a science by herself, the science of productive work". For this author, the science of technology would encompass the constitutive elements of the work process: (a) the work itself; the worker, their energy, their ability, their professional and technical training, the ergonomics, industrial safety, etc.; (b) the objects of work: the materials on which their activity is made possible and the "new or' second nature" modern materials; (c) the means of work: machinery, and tools.

There would have to be a widening of this characterization that incorporates the importance that a collective mode of work requires: the emphasis in the people and in the coordination amongst them, and communications at all levels in the productive company. Calhoun (19**) states that there is a need to remove any exploitive controlling class [so that the workers] will begin to feel that the work process and its results are theirs," thus establishing a collective work ethic (p. 34).

The MIT Commission on Industrial Productivity supports this notion in another sense. According to the members of the commission, research ingenuity do not automatically proceed to become commercial or production ingenuity. We could then say that technology is found in this large trip between scientific discovery and productive ingenuity. In technology, there are many more factors than can be found in the organized discipline of science. The factors intervene with common and various different organized academic disciplines, and distinct professions. They require a very exact appraisal of the atmosphere, and in fact of the available resources, of the collective work organization or rather of the workers - and of the way it is expressed in other dimensions of life: the continuous review of production processes and product characteristics; consumer demands; the nature of the goods and service distribution processes, and the legal and corporate trade laws.

The relationships among science and technology are not linear and one sided, they require physical " capital (plant , machinery, assembly lines, power, instrumentation, computers, all tangible embodiment of technology) [and human capital] (specialists skills and organizational skills)" (Galbraith, 1973, p. 39). They are relationships among the educational or academic world and the productive world, among research and development. On the one hand, each one of those ends of the relationship has its own objectives, its own social, economic, and political significance, its own dynamics: each are categorized by the subject that mobilizes it according to interests, expectations, each has different capacities and disparate interiors. On the other hand, they are socially consolidated in very different transitory levels.

In the current state of technological development of some countries, not only is it required that they clearly detect the scientific and technological opportunities that will be made available in advance to the collective industries of the contemporary open world economy, they also must detect the re-accommodation of the international markets. In fact, these countries face three challenges in technological development: (a) without a doubt they must achieve a prevalence of advanced technological developments; (b) but at the same time, they must achieve technological developments that are successful at solving the old organizational and productive problems, where adopted but now past technologies have already failed; (c) and they must avoid repeating the mistakes and problems that technological development created in the industrialized countries and impact non-industrialized countries with more force: such as the disregard of the qualitative aspects of a countries way of life, the destruction of the environment, the concentration of power and income.

Role of Social Sciences

From here, the national scientific and technological programs must not be divided from the larger social and cultural objectives that are imposed by modern democratic requirements. The social sciences should play an important role in order to sponsor complete world comprehension in which human societies live and act, to mastering technologies that develop, and to explain the interrelationships of science, technology and society, to overcome the fears of anti-science and anti-technology ideologies (Fukiyama, 1992, p. 87). There must be strategies that incorporate: (a) the political will and ability of people and governments to attack root causes; (b) a technical ability, backed by institutional supports such as credit, market availability, etc., to meet a county's requirements , and to ensure equal access to the fruits of production; and (c) a decision by society at large to be individually committed to the implementation (National Committee, 19**, p. B-10).

There would have to be support for research directed towards endogenous development: "that capacity to put it in use for its own end, using the means of scientific knowledge, and to know that which humanity has accumulated it in large quantities to date " (D. Reséndiz).

Perhaps one of the conclusions that could be derived from an in-depth study based on some country's experiences over the last years from supporting science and technology, would be that there was fundamental carelessness in institutional support to the sciences, to the collective dimensions of this important human endeavor, in its integration, and its interdisciplinary approach. The construction scales and dimensions required for research and development institutions are themselves, beginning to be the objects of analysis among some interested parties (Edwards, 1993, p.88).

From here, there are two recommendations that I consider prudent in this regard, and they are:

1. The support of strong institutional agreements that seek and sponsor the integration of technological development, basic sciences, and high level human resources training: engineers and scientists. We are speaking, of a very fruitful interaction among basic science and technological development, pursuant to the former where last can be as important in the generation of theory as the first. The need to add "cognizant" training on a large scale, the reason

by now is understood. The privileged social area in which to achieve this integration is through the academic institutions.

2. There needs to be an interdisciplinary orientation for a better understanding of the different productive sector dialects in some countries. The possibility of this transformation demands very high level knowledge, practically "cutting edge knowledge" that is still not defended or adhered to by international science. The inter-discipline approach, as sown through hard failures and its now well known consequence, is the most difficult of the fields of knowledge.

The establishment of new relationships among research, technological development, high level human resource training, and a country's equitable economic transformation must be considered as the most important end in a national development strategy. The educational, science, and technology policies must be bound intimately, and strategically, to economic and social development plans, to form an inseparable part of the same. The collective civil society must express their opinions in order to be committed to defining their futures.

In the last two decades, those responsible in the impressive success of science in Central American countries has carried and increase interest for defining the orientations of science and technology, and to increasingly designate their own political, economic, and social purposes specifically and explicitly. Friedmann (1984) identifies this change process as "social learning" (Korten & Klauss, 1984, p.190). In his essay Planning as Social Learning, Friedmann also provides a review of guiding social change where John Dewey had "advocated a scientific, open ended approach to planned social change, yet he refused to say who" would be responsible for the implementation and participation, whereas Lewis Mumford proposed social surveys that would be carried out "by the region's inhabitants themselves" (Korten & Klauss, 1984, p. 190).

We are not trying to suppress scientific autonomy or to substitute the "pulse of science for science" by the "optional directions of science as functions of market demand". But is worth the trouble to widen the margin of participation of those who do construct the large questions that are researched. We can not hold the productive sector responsible for their disinterestedness in financing research. "Scientific research fulfills a wide social function as an istitututional support for the total educational system, which is conceived both as the transmission of existing knowledge and the creation and dissemination of new knowledge, all made available to the general culture," that is, if something is done scientifically, then it is done correctly (Irele, 1987, p. 129). The researchers have neither worked for achievement nor have provided relevant answers pertaining to the needs of industry, many times, we have not even concerned ourselves with the questions. Where the ingraining of this material into society then becomes what Irele (1987) called a "cultural mode, " is lacking (p. 129).

We try to establish cooperative and communication mechanisms at very different institutional levels, always within respect to logic, dynamics, and the atmosphere that the quality of academic purpose requires since the autonomy of research completely fits in.

Qualified representatives participation from productive sectors orient the programs through the construction of large institutional questions for research, development and teaching; the opening of apprenticeship spaces in industries, and shared financing, a fluid circulation of educators and workers among the academic institutions and the productive establishment.

Undoubtedly, this ambitious project requires many resources.

It requires that new forms and sources of financing are made necessary, with an important contribution from the productive sector. The project has to support, at all costs, the subsidy that this new academic activity demands as a public function. From there, the state will have to continue to play a primary role, certainly such as that which happens in countries such as Japan and Germany.

Conclusion

To conclude, I want to revisit the ideas of a recent study from the "Organization of Cooperation and Economic Development," with those which we can plainly identify ourselves, that of the scientific and technological priority selection process is one of a dialects between two logics: one of which is scientific knowledge, and the other being the comprehension of economic necessities and specifically the needs of Society.

The eras of scientific research and those of the economy are different, their logic's are also different. Which would be the purpose of scientific policy? To approach this area, it would be to appropriate the corroboration of scientific objectives with the needs of the economy and those of society, equally respecting their respective logic's.. Which would be the purpose of a national technological policy? That which would not have appointed the exclusive mandate of "to bet on only the winners", neither let it be the "market lottery" that makes it. A technological policy should stimulate the development of opportunities from those which would provide the largest number of possibilities for satisfying the social needs of their populations, and that permit them to open a space in international corroboration, sponsoring goods and services exchanges that are just and balanced. The answer seems more complex.

FINAL CONSIDERATIONS

Recent years have shown us that permanent technological innovation is the basis of competitive companies, and it is the only means for staying in an increasingly larger, but more competitive and sophisticated market, but also, therefore to use technology as a strategy means structural and organizational changes for our main industries.

Proceed with the integration of different functions: research, and development, conception, production, and marketing which can change a uniform massive production process (standardized) to a quickly changing massive production process, proceed with an economic scale and a range of products that permit investments in research, development, and the increasingly costly production process to be profitable.

Sharing

These changes have important consequences on the human resources effort. They imply modifications in increasing personal capacity, quantity, and flexibility that go with the sense of traditional qualifications, as seen in the Japanese experience. To these internal changes, we can add external organization: the changes in the nature of relationships that are established with other companies. We support the dizzying multiplication of strategic alliances among industrial corporations that are based on scientific and technological advancements. This new sort of relationship shares technological innovation advances among participants as an objective, placing increasingly wide and complex knowledge in common reach, sharing in research and development costs, and in the risks that are represented in the new market imperatives. These actions are even extended to the very advanced phases of research and technological development, configuring a novel aspect of cooperation / competition through which collaboration in scientific and technological matters is compatible with concurrent levels of applications and markets.

Support

Technology, to be productive and make sense must be intensely supported by corporations, but it is the governments responsibility to create the conditions that assure and permit their development and their competitiveness. Wenk (1989) delves into the process that brought government to the forefront of technology. He surmised that technological affairs were largely the province of the private sector and that the owner/entrepreneur discovered new techniques to concentrate energy to meet human wants and needs. He notes that as technology became entwined in society, decision making shifted from the market place to government , and provides examples of how government is now involved in the private entrepreneurship and investment in technology through land grants, subsidies and tax incentives. The private sector is is also assisted by government funding with support for education, training and research and development. The capital markets of economies are influenced by governments, along with interest rates and inflation. Government intervenes through regulatory processes when technological activities from the private sector are inimical to the public interest. He concludes this discussion with the fact that the government is also a major consumer of technology (Wenk, 1989, p. 22). Ackoff (1984), supports this in his essay On the nature of Development and Planning as he states that, "a government can not develop a country; it can only help its country develop itself" (Korten & Klauss, 1984, p 195). Again, interaction and accumulation are the keys indicators that should provide the indicators concerning the direction of national policies in science and technology, research and development, and modern engineering training.

Diffusion

The access to scientific knowledge, workers that are qualified, qualified technicians and engineers is unquestionably a necessary condition for the competitiveness of local companies. These are clearly a dominate responsibility of the public sector. Before growing important strategic relationships that should be established in the academic areas and public teaching with that of research, and training within the productive sector (companies), the public powers have an important role to perform in the establishment of a mode of exchange and collaboration. The diffusion of "knowledge" towards industry, and the diffusion of "know-how" towards the university depends generally on a political decision. The examples provided for international cooperation come from programs such as "Eureka", which finances the commonly needed research and development projects for companies, and the 19 European countries research laboratories, are very meaningful.

Cooperation

The existence of quality interactions among the teaching institutions, research and industrial means, as well as the different manufacturing sectors and of services, contributes to training in competitive areas. Their cooperation can drive companies to establish in places where they can be benefited, thanks to the processes of knowledge accumulation and greater yields of "Know-how". It has been demonstrated that a country's competitiveness can be supported on these sorts of actions, and where again the public authorities have played an important role in sponsoring and supporting their establishment. The examples of science - technology parks (Silicon Valley, the Research Triangle, etc.) in the United States of America, England and Germany, and the creation of the "technology incubators" are intended to be studied with great attention.

tecno-globalism

In the eighties, we were presented with a new form of internationalism that was characterized by a growing volume of direct international investments, and by its structural modifications and progress. This last phase is perceived by the globalization of industrialized economies, technology is identified as one of the factors of this globalization movement. The term "tecno-globalismo" has been coined to represent the growing interrelationship that exists among technology and the economy, and drives multiple cooperative agreements among companies (acquisition, coalition, cross participation). As such, there are firms that can be called global because they operate in the world economies, apart from the various units that are distributed around the world each of which is relatively autonomous and interconnected to the others, taking advantage of the local competition. Chowdry (19**) found there to be four challenges: (a) the inter-relationship between poverty , resources and people, where poverty is a status and po0verty has consequences that affect resources, people and institutions; (b) the challenge to empower people to control resources, people and institutions; (c) the empowering of eople to ensure equitable distribution of resources; and (d) the need to be responsive to local needs (Chowdhry, 19**, p. 143-145). Thus, global companies operate in the world market and appear as several similar units that are distributed and at the same time, remain relatively autonomous and interconnected to the others, that take advantage of the local competitive opportunities (qualified labor, quality industrial support (infrastructure), access to scientific and technological sources, to good engineers, etc.) fully. Once again, it appears that the phenomenon of "tecno-globalismo" is one direct result of the innovation process characteristics: competent interactions and accumulations that are strategic are taken into account; by the world wide companies.

Risks

The apparition of global companies, and the creation of strategic alliances among them, imply a susceptibility to the creation monopolies or world-wide oligopolies, and consequently, to the forging of concurrent principles at the international level. Without doubt, to control this global scale risk, there will have to be a systematically evaluation of national competition and divergence policies, and a drive to harmonize multilateral rules and their applications in order to prevent another crisis as emphasized in the Carnegie Council Case Studies (19**).

The crisis resulted from the indepted industrialization that had occurred during the lost decade. Gendron (19**) points out that "in the post industrial age, continued technological growth will lead to the elimination of economic scaricity; and the elimination of economic scarsity will lead to the elimination of every major social evil" (Gendron, 19**, p. 13). Therefor, technology is the cause of decreasing scarcity" (Gendron, 19**, p. 17). "technology will transform power structures into technocratic power structures (and thereby facilitate the struggle against scarcity)" (Gendron, 19**, p. 21).

Conclusion

As I had previously drawn, "among the countries that exist, and without any lasting doubt, differences can be qualified as structural because they have to deal with for example, the size of the country, its culture and its history. It is illusory to think that you could be established any political base on the hypothesis of a rapid erosion of these differences. Thus, the international friction risks are outlined while the phenomenon of globalization paradoxically grows. The limitation of the perspectives offered by a convergence's national policy plan calls for a multilateral and systematically exam of those differences" (OECD). An obvious test of compatibility is exemplified in the European common market.

We face a certain number of problems of great importance equally, for example, environmental pollution, global climatic change, food autonomy in the underdeveloped world, etc., which demand solutions founded on international cooperation, the coordination of efforts along with the distribution of tasks and responsibilities, that is, a renovation of the international game rules. It is within these current circumstances that the university, scientific, and technological systems of our countries should establish, with the society, the strategies that design their future, and the accelerated training strategies for their engineers and scientists.

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