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THE KNOWLEDGE SOCIETY AND THE LATIN AMERICAN COUNTRIES COMMUNITY*

Prepared by

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I. INTRODUCTION (AND ABSTRACT)

This paper presents a view on the challenges and opportunities facing Latin America in view of the paradigm that is emerging worldwide - the "Knowledge Society", engendered by the extraordinary advances in Science and Technology as well as by the upgrading of education in society.

The competitive entry into the Knowledge Society becomes a considerable challenge, even for the industrialized countries, since the world economy will be dominated by products with "high intellectual content" and competitiveness will increasingly depend on acts of innovation.

The serious economic conditions of Latin American countries severely limit the available resources for overcoming that challenge. As one of the possible regional responses, the paper proposes the search for innovative approaches, not only in high technology areas, but also in planning and policy making. Specifically, it calls for action that, depending more on the imagination and political will than on money, may significatively improve the region's odds in facing the future.

Among them, the paper suggests the setting up of a program of "innovation habitats", including historical districts, technology parks and technopolisis, as part of a national project within a "Latin American Project for the Future", with a span of centuries. It suggests, also, that Latin American universities play a more participative role in the regional development and integration processes, through mechanisms designed to increase its revenues and to improve its interaction with society as a whole. Finally, it suggests regional cooperative projects on educational processes and on new technological paradigms, in order to gather opportunities brought by new industrial scenarios at an early stage.

II. THE CHALLENGE: A COMPETITIVE ENTRY FOR LATIN AMERICA INTO THE KNOWLEDGE SOCIETY

According to the distributed informations regarding the Expert Group Meeting on New Materials, UNIDO "is assisting developing countries in their efforts to narrow the technological gap with the industrialized world and to develop their ability to benefit from the new materials age by developing their export competitiveness, as well as working actively in the transfer of advanced new technologies from developed to developing countries".

In this framework, the participants were asked to focus on constraints and barriers affecting the development of new materials field and explore options for feasible initiatives suitable to stimulate development of advanced materials technologies for sensors and everyday life systems.

To adress the subject, let us suppose a technological breakthrough were achieved at a Brazilian or a Latin American university, that could generate innovative products and new industrial ventures. This would scarcely represent a sizable contribution for regional development, since the outcomes would hardly reach the productive sector. Transmission links between the research and the productive sector such as companies incubators in the universities, venture capital and technology parks, to say just a few, are insufficient and inadequate.

That situation becomes more worrysome when one realizes that it reflects the region's unpreparedness to stand up to the challenges of a completely new era for humankind - the Knowledge Society- and when one recalls that is not possible to successfully face a new paradigm without adequated theories and tools (1).

The Knowledge Society, in fact, represents a new social paradigm, since it deeply and radically affects all social domains (Economical, Political and Cultural), requiring humankind to forge concepts and instruments to understand and to handle extraordinary new realities. Some of the conspicuous characteristics of that new social paradigm could be listed as:

A. IN THE ECONOMICAL DOMAIN:

- Science and Technology will continue to generate new paradigms and will therefore continue to offer market opportunities for new products and new industrial ventures.

- The world market will increasingly be dominated by goods and services with a high intellectual content.

- Competitiveness at the national and company level will be dependent upon INNOVATION ACTS, that is, the result of creativity associated to organizational capacity, and not of classical comparative advantages (2).

- Chronic structural unemployement may emerge as a byproduct of automation and other high technology possibilities.

B. IN THE CULTURAL DOMAIN:

- The redemption of humanism in the Renaissance sense (although paradoxically one may witness the resurrection of an ancient kind of wall, formely used to prevent the disinherited hordes from invading the empires).

- The search for philosophical answers as the educational level of society rises and leisure time increases.

C. IN THE POLITICAL DOMAIN:

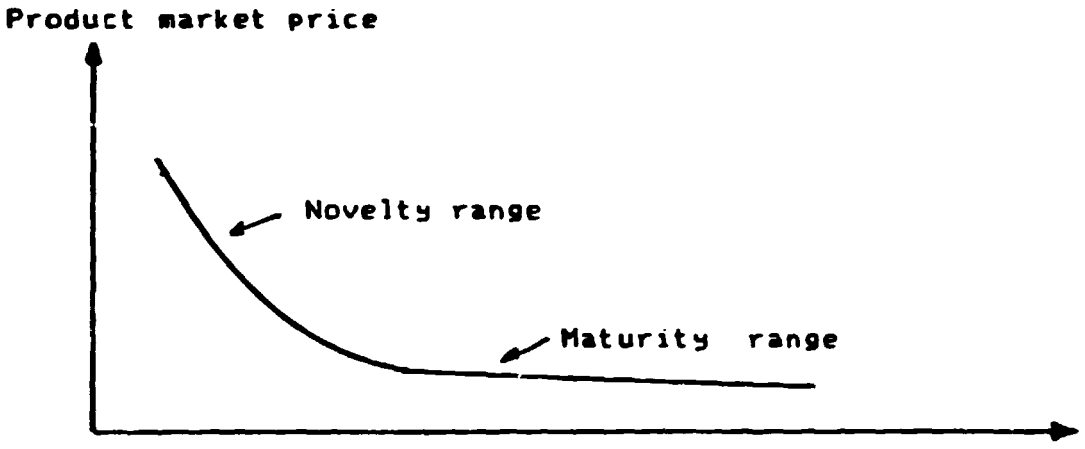
- The formation of economic blocks and of communities of nations.

- The enhancement of democratic values.

- The enhancement of governmental functions related to the maintenance of conditions required to keep democracy alive (3), to keep sustained development and to improve planning with a view to a worldwide perspective.

Now, let us focus on developing countries competitiveness, the first key idea of the Meeting. Or, perhaps more broadly, let us focus the challenge of the competitive entry of developing countries within the context of the emerging paradigm of the Knowledge Society. The learning curve (Figure 1) may illustrate the initial dilemma brought by that challenge.

FIGURE 1. THE LEARNING CURVE



The market accepts high prices for a novelty, but demands low prices for products that have become commonplace. A first srategy to assure competitiveness would be to work over in the whole lifetime span of some selected items. In the novelty range, through the continous generation of innovative products. In the maturity range, through industrial, managerial and marketing processes conducive to high-quality and low-priced products.

Countries which do not have resources to invest in research that leads to technological innovations may be tempted to give up the novelty range, in order to concentrate in the producing low-priced high- quality commodities. The feasibility of this strategy, however, is questionable, since the high speed at which innovation takes place substancially reduces the market demand for a certain product. Within such short lifetimes, a new product virtually becomes obsolet still in the novelty range and disappears without reaching the maturity range.

Fortunately, the intensive intellectual content products are not limited to high technology products, field in which creativity requires joining knowledge and reason. There is an extraordinary scope of goods and services related to fields in which sensibility is the source of creativity, as are the arts, publicity, fashion and education. But also in those fields competitiveness will not be dependent only upon creativity, but on its union with organizational capacity.

The competitive entry into the Knowledge Society is therefore a considerable challenge, even for the industrialized countries. To overcome it, those countries are adopting a series of initiatives, among which this paper focuses on "innovation habitats", the up-grading of educational processes and regional cooperative projects in high technology.

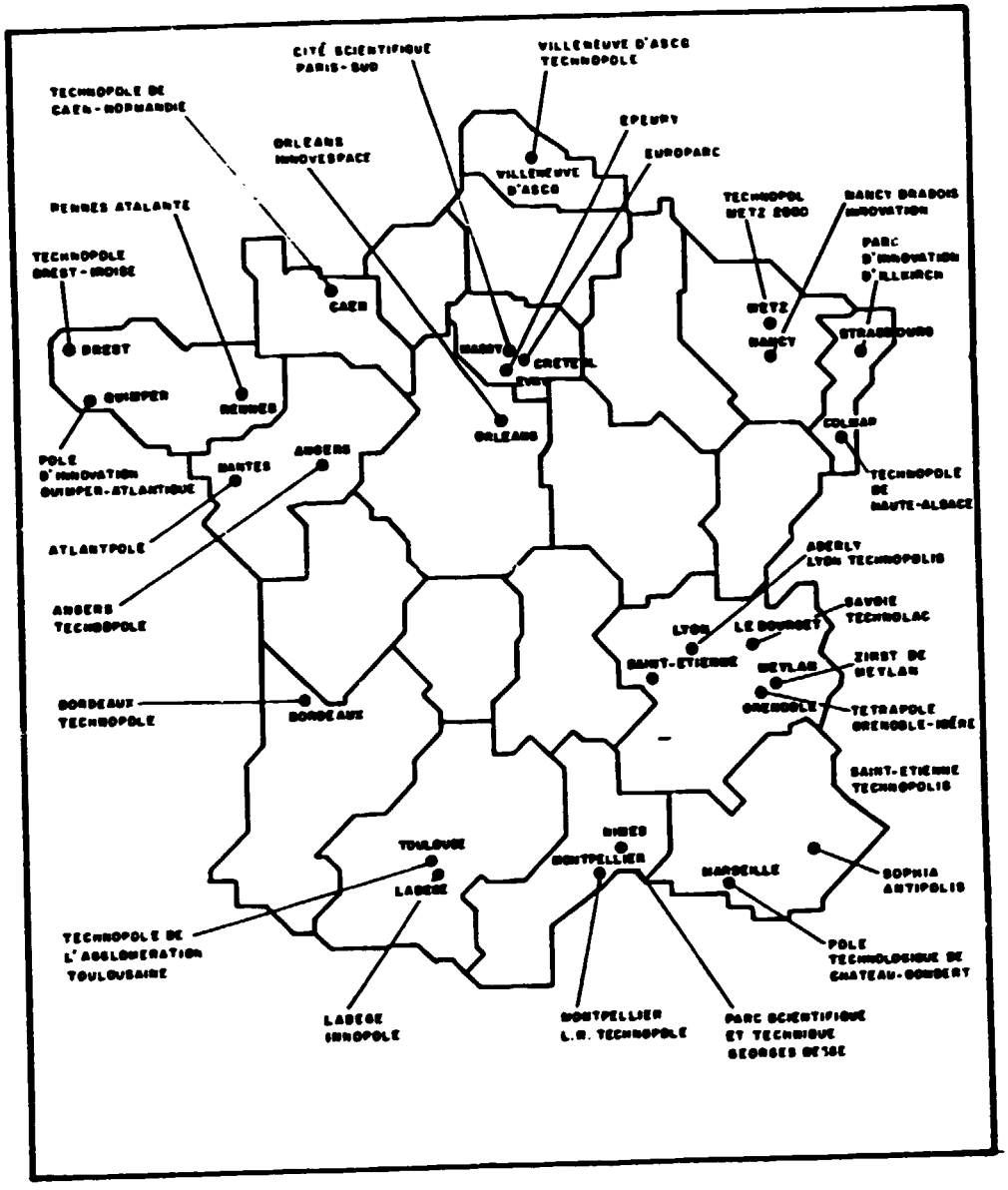
As far as the innovation habitats are concerned, the industrialized countries initiatives look for the conditions which seem to propitiate the creativity and its practical uses. The atmosphere of the classical "polis", with its effervescence and diversity, seems to favor the innovative process in fields more related to the brain's emotional hemisphere, as the arts. On the other hand, in the scientific and technological areas, the innovative process seems to rely on the sinergy of universities, research centers and industry, as well as on quiet and tidy environments.

The preservation and restoration of historical districts is an attempt to recreate the atmosphere of the classical polis. Besides the European initiatives, several North American inner urban areas have been revivified, in an extraordinary way, by turning old factories and docks into meting spaces that remind one of the agoras in ancient Greece.

The continuing and successful phenomenon of high technology companies and innovative products creation observed in areas which emphazise the amalgam of reason with knowledge, as in the Silicon Valley, has been motivating attempts to reproduce their conditions, through approaches as high technology clusters or poles, technopolisis, technology parks and company incubators. Japan is setting up 23 technopolisis (4 and 5). There are more than 50 high technology clusters in the United States, counting upon special local development agencies (4 and 6). Technology parks and technopolisis are mushroomimg in Western Europe, as shown in Figure 2 in the case of France (7). South Korea announced its intention to set up a technopolis (8).

Now, in face of the new paradigm, in face of a world racing for competitiveness, with industrialized countries adopting strategies that span decades and in the face of most serious prospects for Latin America, it is urgent for the region to rethinks the contours of its strategical planning and development policies.

FIGURE 2.
TECHNOPOLISIS and TECHNOLOGY PARKS IN FRANCE



(Source: TECHNOPOLIS INTERNATIONAL, N 2, Septembre 1990, PARIS).

III. INNOVATION: A POSSIBLE RESPONSE ?

As has been already emphasized, it is not possible to successfully stand up to a new paradigm using obsolete theories and tools. In this connection, aiming at contributing to efforts to set up adequate tools to overcome the challenge, may we recall that, at the end of the 19th Century, it was already recognized that an efficient public transportation system was vital in order for a great town to become a polis, in the classical sense, and not a mere anarchic urban agglomerate, destructive of its own civilization. It was also possible to evaluate the enormous cost of the underground train (metropolitain) as well as the prohibitive costs of urban areas expropriation.

If, from that time on, every town in Latin America had reserved land for a network of infrastucture corridors, which would precede urban occupation, it would have been possible to prevent the chaotic growth of a considerable number of the Latin American towns and its disastrous consequences. It would have been possible to build efficient public transportation systems with investments that today are just enough to build a few and insufficient kilometers of underground trains or questionable elevated highways. Perhaps today Latin America would be a developed region, since more resources for education would have been available.

Now, taking into account that the existence of those corridor systems required no money, but only imagination and political will, we may transport the situation to the present and look for initiatives that could replicate the corridor systems outcomes in the future. The suggestions of the next chapter were conceived within that perspective.

IV. SUGGESTIONS

SUGGESTION 1: AN INNOVATION HABITATS PROGRAM

A program aiming at promoting the development of innovation habitats, with two master plans, could be initiated by each country in the region. The first plan would deal with habitats as the historical districts. The second one, dealing with high technology, would look for the simultaneous existence of all the conditions required to successfully generate Silicon Valley's clones, which are (9):

1- Outstanding institutions of higher education and research, in fields as Engineering, Nature Sciences and Medicine.

2- New scientific and technological paradigms.

3- Favorable national policies and markets.

4- Favorable entrepreneurial atmosphere: free initiative, venture capital, simple operating procedures, fair competion etc.

5- Educated population and high quality of life.

6- Environment favorable to innovation: liberty, free questioning, intense synergy etc.

7- Adequate extensions of land.

8- Maintenance of all above conditions.

Each country could identify the sites that show potencial to nurture a high technology pole with one or more technopolisis. A method for that selection was proposed by the author (9). An urban and regional development planning would follow. However, in order to prevent the necessary areas from being devoured by urban sprawl it is essential that Latin American countries do possess

laws allowing to destine land for future uses without immediate indemnification to the landlords. Assuming that condition for granted, the foreseen technopolisis could have the following initial characteristics.

- Planning span of centuries.

- Surface ranging from 200 to 3000 km2, with vast areas for the university future extended campi and technology parks, besides the areas for all the other elements of a town.

- The technopolisis would be crossed, and linked to other towns, by an "Infrastructure Corridor System", three kilometers wide, containing conventional and high speed trains, conventional and future "intelligent highways", roads for cyclists (ciclovias), fiber optical cables and other infrastructure services. The corridors would also assure a "continuum" of green areas and leisure parks.

- These corridors would be interconnected to national corridor systems and to the "Latin American Infrastructure Corridor System".

- Shopping centers, supermarkets, hotels, restaurants etc would participate of the corridor systems, as part of urban and regional development plans.

- Part of the real estate added value outcomes, due to those planning, would revert to educational and research institutions.

- A redistribution of the collected taxes would assure a fair budget to all involved municipalities, regardless of a possible taxpayers concentration in a few of them.

- The technopolisis and the corridors should constitute a masterpiece concerning urban planning, environment protection, quality of life etc.

- The more fertile areas would be preserved for agriculture.

SUGGESTION 2.
RETHINKING THE UNIVERSITY-INDUSTRY INTERACTION

In the Knowledge Society, as already emphasized, synergy of outstanding higher education and research institutions with society as a whole will be essential for innovation in all fields of human activity. Within this perspective, some suggestions are presented hereunder aiming at to enlarge and improve that synergy in the case of Latin American universities.

2.1. RESIDENCE FOR THE STUDENTS IN THE CAMPUS

Students living in campus or very close to it is a major characteristic of an outstanding university, which is a high technology cluster existence very first condition.

Assuming that Latin American universities have - what is not the general case- large campi, but no resources for constructions, private companies could be invited to built and to explore campi residences, according to rules set by the universities.

2.2. COMPANY INCUBATORS IN CAMPUS

Research and higher education, in adva.ced scientific and technological areas, may lead to innovative products and ventures creation by professors and graduate students. To nurture those initiatives, which may be the first step to worldwide successful companies, the universities could adopt attitudes favoring them, as setting up intramural company incubators and by authorizing professors, in a part time basis, setting up and running their own companies there.

The intramural incubators could be disseminated throughout the university departments, in order to assure maximum interaction between research and emerging products or companies. As companies evolve, in that "Phase One Incubator", they may wish to move to larger areas, without losing privileged interaction with the university. The "Phase Two Incubator", in a technology park in campus or in adjacent areas would respond to that need. Additionally, a fellowship program could be shaped to give support to fresh PhD's and professors who may wish to try the entrepreneurial way.

2.3. TECHNOLOGY PARKS

University campi, or nearby areas, could shelter technolo.y parks, that is, an institution with management aiming at promoting synergy and the setting up of high intellectual content companies and R&D centers in the park (10). In those parks, universities could set up entrepreneurial centers- "Unicenters", built and explored by the private initiative, according to rules set by universities. Those centers would shelter the "Phase Two Incubators" as well as companies and professionals related to high intellectual content goods and services and willing to interact with the university.

2.4. INNOVATION SPACE -INNOSPACE

The technology parks may be part of something larger, a kind of a space for innovation -"Innospace"- designed to promote and improve the synergy of the university with society as a whole.

Although owned by the university, Innospace building constructions and management would be carried on by private initiative. Besides the technology park, Innospace would harbor an innovative shopping center -"Unishopping", theaters, innovative educational museums and services shops. These business would pay

a rent or a royalty for the university, since it is fundamental for it to get more resources - and the governments are short of money- to be an outstanding institution.

The Unishopping would be an entreprise in tune with Knowledge Society characteristics. Besides the conventional anchorage shops, it would shelter excelent libraries and music shops, art galleries, antiques dealers, artists ateliers, craftsmen workshops and shops dealing with items as scientific instruments, high tech products, environmental protection, nature cult, hobbies and educational toys. It could count on "anchorage activities" as courses on arts, idioms and aerobics as well as wide span of services.

Finally, a kind of meeting space would be created, close to the Unishopping and other atractions, where artists could play and speakers harangue, completing the agora atmosphere.

2.5. TECHNOPOLIS

The university campus, the technology park and the innospace, on its turn, could be part of something larger, a technopolis. Designed from sketch, it would be a town aiming at the integration of human knowlege, sentiments and aspirations, in order to further, besides happiness, conditions conducive to innovation, mainly in the scientific and technological areas. Naturally, the technopolis could be a fantastic source of revenues for the educational and research institutions.

However, in order to bring technology parks, innospaces and technopolisis into existence, in Latin America, it is fundamental, as already stated, that the region counts on adequate juridical instruments, such as the possibility to preserve land for future use without immediate indemnification to the landlords.

SUGGESTION 3.
LATIN AMERICAN COOPERATIVE PROJECTS

3.1. THE PARADIGM PROGRAM

It is not a trivial undertaking to organize multinational cooperative project on high technology domains . The EEC, starting in the fifties, only in the 80's launched the EUREKA Program (11).

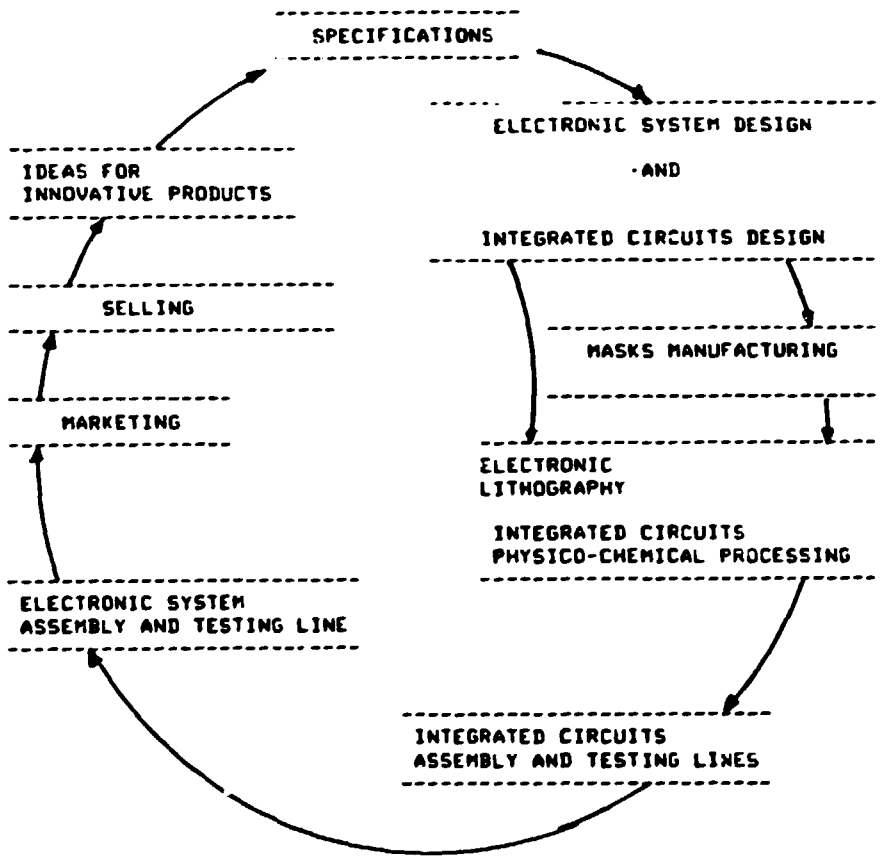
Keeping that in mind and taking into account Latin American limited budgets, the regional technological cooperative projects could initially look for new paradigms, since they generate challenges which may stimulate the cooperation and offer opportunities to new comers who succed in joining their creativity to new prevailing factors in the emerging scenarios (12). One may recall asian companies, in the sixties and seventies, that, although had no tradition in the wrist watches and fine mechanics areas, took advantage of an emerging paradigmy -the integrated circuits- to replace, with benefits, mechanics by electronics, and conquered a considerable part of a market where traditional european companies were presumed to be invencible (13).

In this perspective, when this paper was being writen, Latin American Integration Association- ALADI was calling for a technical meeting, in september 1991, in its Montevideo headquarters, regarding the proposal of the "Paradigm Project", presented by the Brazilian representative (13).

The Paradigm Project objective is to articulate the international and regional projects and initiatives regarding training and research activities on integrated circuits designing in Latin America as well as to pursuit industrial outcomes of those activities (13).

The proposal assumes that integrated circuits ever increasing density ultimately will provoke a new paradigm: electronic systems implemented with a single integrated circuit. In that situation, as illustrated in Figure 2, creativity to conceive new products, integrated circuits designing capacity and fast introduction of products into the market will define the competitiveness edge (13).

FIGURE 3.
INDUSTRIAL CYCLE ASSOCIATED TO ELECTRONIC SYSTEMS



In the one-chip-equipment paradigm cycle, creativity to conceive and design products and its fast introduction into the market will define the competitiveness edge (13).

In this context, the Paradigm Project suggests that Latin America cooperative efforts on electronics initially focuses on developing the new scenario prevailing factors, considered accessible to the region (13). For that aim, the Project recommends the set up of a technical committee and an executive secretary, which would articulate the distinct international and regional projects in integrated circuit designing area looking for undertakings as:

- Designing tools compatibility (hardware and software)

- A consortium for buying designing sofware.

- To recommend the adoption, if necessary, of adequate legislation to protect the software and the integrated circuits topography intellectual property.

- A consortium for administering the regional multichip projects and an integrated circuits cells library as well as for contracting silicon foundries manufacturing services.

- To recommned instruments for increasing the regional trade of locally designed electronic systems and integrated circuits.

- Testing and homologation regional procedures and compliance with international technical specifications.

- Cooperative integrated circuits design and cooperative software development.

- Cooperative updating of the electronic engineering courses curricula.

- Continuos programs for training and updating experts.

- Periodic microelectronics regional conferences.

- Networking the project participants.

- To recommend instruments, in the area, aiming at to further the interaction of the universities and research centers with the industry as well as to support spin-offs (companies incubators, technology parks, venture capital etc).

- Applying for funding in name of all participants.

- Regional strategies concerning the "one-chip- equipment" paradigm industrial complete cycle.

- Interaction with other region's cooperative projects.

The Paradigm Project could be seen, therefore, as a consortium designed to handle problems arisen by the dayly operation of an extended multinational cooperative effort, in a challenging high tech area and counting on distinct projects. Its success may engender the "Paradigm Program", reuniting similar Latin American cooperative projects.

3.2 THE MACROPEDIA COOPERATIVE PROJECT

Huge interactive museums, to give just one example, reflect industrialized countries efforts for upgrading their educational processes, since education, undestood as the continuous process of the development of the physical, intellectual, moral and esthetical capabilities of the human being, is acknowledged as the cornerstone for competitive entry into the Knowledge Society.

In this context, Latin American universities could initiate a cooperative project aiming at an interactive educational museum system called, temptatively, "Macropedia System", which major objective is to fascinate the visitor with the cosmos magnificence and the human epopee enchantment. Such fascination, seen by Aristotle as the philosophical thinking first step, would therefore stimulate the visitor to respect Humankind and Nature and consciously adopt the ethic standards that make civilized life possible.

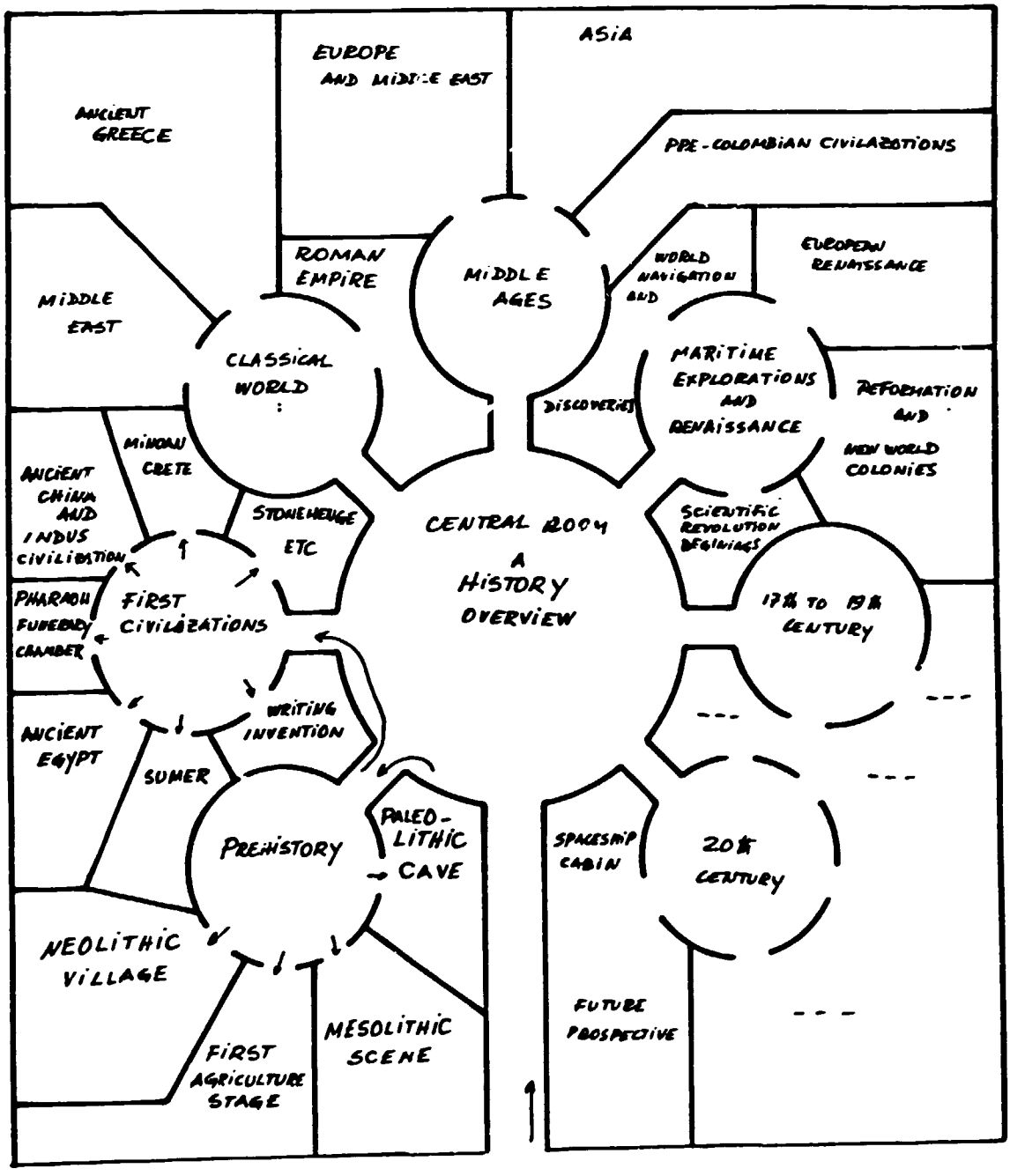
The Macropedia System second purpose is promoting the "Knowledge Engineering" concept, that is, the systematic integration of human knowledge, sentiments and aspirations in order to stand up to the Knowledge Society ever complex multidisciplinary challenges, such as, for example, since writting a software manual that can be understood by non-specialists till designing and setting up an ideal town to live in.

The Macropedia System is formed by interactive museums which amalgam traditional museum characteristics with technology possibilities and amusement parks magic. A Macropedia museum visit should be a playful space-time trip into History, Arts, Ideas, Science and Technology and other fields. The museums contents re displayed in such a way as to invite continuos knowledge structuring, from the general to particular. As an example, figure 4 shows the History Overview Module layout of the Macropedia History Museum. Entering into the module, the visitor finds a circular room, which wall exhibits an overview of History main epochs. Beneath each epoch there is a door, through which the visitor litterally enters into the selected epoch.

The first epoch to be visited is Prehistory. Again, a circular wall displays the epoch main ages and entrances to each of them. The first age features scenes from life of a Paleolithic tribe, with men and women producing artefacts and mural paintings, and so on. After touring Prehistory, the visitor returns to the central room, and understands it is a kind of "time machine". Next, the visitor enters into the First Civilizations epoch. Once again, a circular wall offers an overview of the epoch and entrances to its main periods. In the first of them, the visitor will meet writing and calendar invention, essential to organized societies. The next rooms are dedicated to Sumer and ancient Egypt. The visitor will understand the importance of the first central governments and the origins of their rulers deification, and will appreciate much better the next step, a visit to a Pharaoh funerary chamber reproduction.

And so, step by step, the visitor will acquire a structured understanding of the human adventure throughout the milenia. Once the tour is completed, specific modules, within the same approach, may deepen History selected themes.

FIGURE 4. MACROPEDIA HISTORY MUSEUM
HISTORY OVERVIEW MODULE



A central room circular wall exhibits an overview of History main epochs. Beneath each epoch there is a door, through which the visitor litterally enters into the selected epoch.

OTHER CHARACTERISTICS OF THE MACROPEDIA SYSTEM

-The museum contents should fallow a rigorous scientific approach.

-The Macropedia System do not need authentic pieces, but replicas and multimedia resources.

-Since it is a research center on knowledge engineering, the System may offer almost inexhautible opportunities for innovative companies, as those in the incubators.

-The Macropedia System should be independent from the government budget. Innovative sources of revenues should be looked for, as renting museum halls for parties.

3.3 THE LATIN AMERICAN PROJECT FOR THE FUTURE

The Innovation Habitats Program working out, requiring integration of human knowledge, sentiments and aspirations, would generate a Knowledge Enginnering structure that could start thinking in a more audacious project: a national project for the future, within a "Latin American Project for the Future", with a span of centuries.

An example of this procedure could be infered from Figure 5, which shows a suggested framework for the technopolisis and the infrastructure corridor system in the southern Brazilian state, the Rio Grande do Sul (14, 15). Analysing that framework, one feels tempted to go ahead and draw other milestones for the future, as the urban areas development, the natural parks and singular sites protection, water and energy aspects etc. The framework stimulates also the inquirying about similar milestones for Latin America as a whole and suggests specific questions, as:

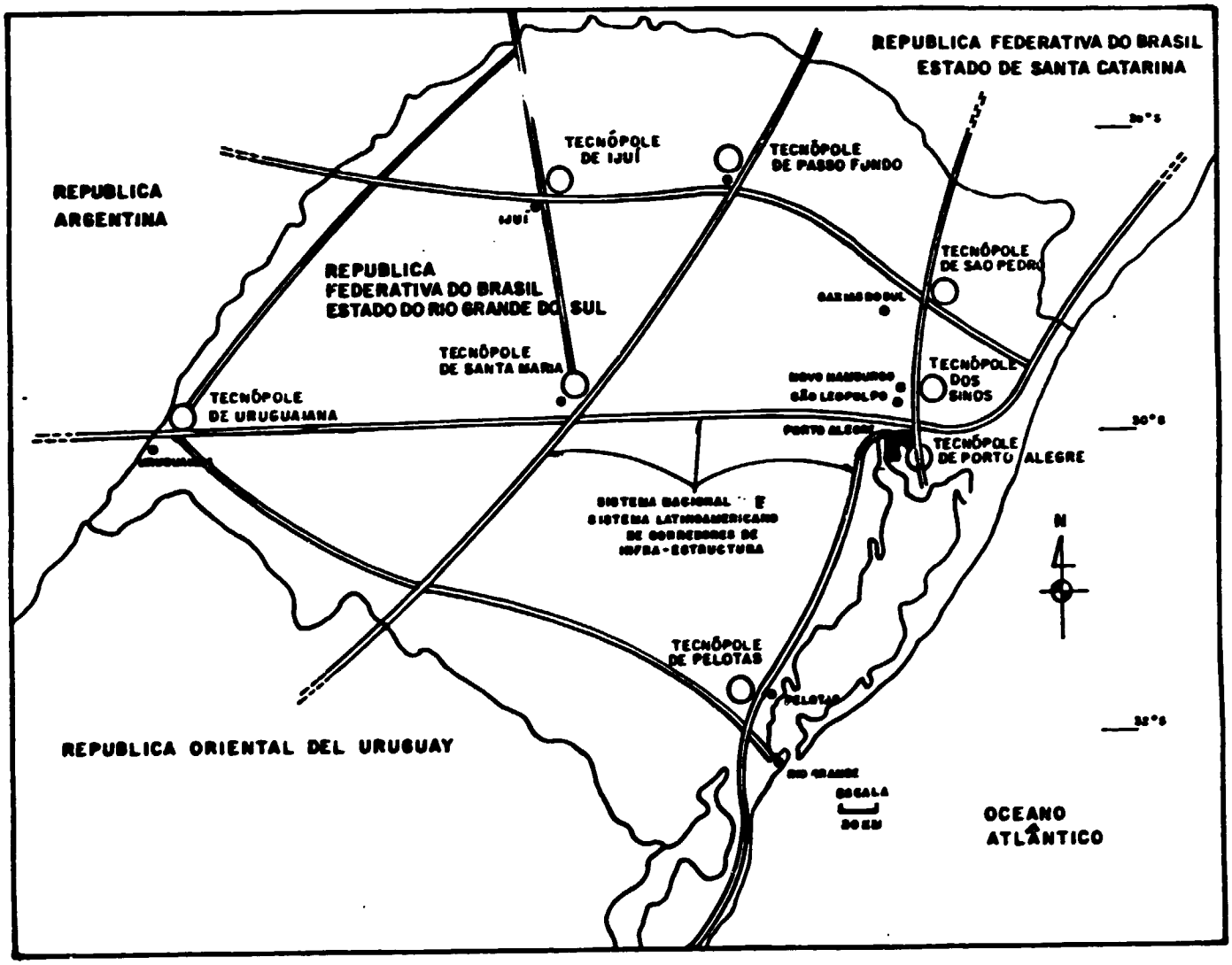
-How the national corridor systems will be interconnected to form a Latin American Infrastructure Corridor System ?

-What will be the specifications of the whole system and how setting it up ?

-What about the high speed trains in the system ? Could the region set up consortia for designing and producing them ?

Within this perspective, each Latin American country, through its universities, could initiate to work out its national project for the future, starting from its innovation habitats program, within a Latin American Project for the Future, with a span of centuries and using a Knowledge Engineering approach. Universities reunite characteristics for that undertaking, as multidisciplinarity, and the initiative could redeem the third mission of the Latin American universities, besides education and research: to be the co-author of the regional development and integration process.

FIGURE 5
PROJECT FOR THE FUTURE EXAMPLE



Technopolisis suggested for Rio Grande do Sul, in Brazil (14, 15). They would be linked to other towns by a three kilometers wide infrastructure corridor system, containing conventional and high speed trains, conventional and future "intelligent highways", roads for cyclists (ciclovias), fiber optical cables and other infrastructure services, as well as a "continuum" of green areas and leisure parks. These corridors would be interconnected to the National and to the Latin American Infrastructure Corridor System.

V. CONCLUSIONS

The competitive entry into the extraordiary new era that emerges worldwide - the Knowledge Society, is a considerable challenge even for the industrialized countries. To overcome it, those countries are adopting initiatives that may span decades and have multidisciplinarity as a hallmark. They range from larger support to universities and company incubators till improved and more subtle industrial policies, passing by educational museums, regional cooperative projects and technopolisis.

In this perspective, outstanding universities and adequated transmission links between research and the productive sector will be among the key factors to overcome the constraints and barriers affecting high technology products development and manufacturing in developing countries.

Brazil and possibly other developing countries still show an unpreparedness to stand up to the challenges of that completely new paradigm, what is not a shame since it deeply and radically affects all social domains and requires humankind to forge theories and tools to understand and to handle extraordinary new realities.

One of the possible developing countries responses to that challenge, without abandoning other choices, would be searching and setting up initiatives that, depending more on imagination and political will than on money, may significatively improve developing countries' odds in facing the future, such as preserving land for universities extended campi and their technology parks and innovation spaces, as well as for technopolisis and infraestructure corridor systems.

Without those initiatives, the necessary areas will be devoured by the urban sprawl and the developing regions will remain without essential tools to stand up to the future.

The simple setting up of those instruments, in spite of their long term outcomes, would bring a breath of hope for developing countries. More than that and above all, it would represent a gift of vision and love from our generation to the children of the future.

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