The Ibero-American Science and Technology Education Consortium (ISTEC): A Partnership for Education, Research, and Development

L. Howard Pollard, Romero Jordán, and Chaouki Abdallah
Department of Electrical and Computer Engineering
University of New Mexico (Albuquerque, NM, USA)

Paulo Franco
Departamento de Electrônica
Pontifícia Universidade Católica do Rio Grande do Sul (Porto Alegre, Brazil)

Mauro Miskulin
Facultade de Engenharia Eléctrica
Universidade Estadual de Campinas (Campinas, Brazil)

Domingo Docampo
Departamento de las Tecnologías de las Comunicaciones
Universidad de Vigo (Vigo, Spain)

Abstract *- The world has become information and technology dependent. The use of Information Technology is an effective indicator of the difference between developed and developing nations. Many countries of the world are in the process of adapting in order to make use of Information Technologies, with the degree of success being directly proportional to strategic investments in science, technology, and information systems. These countries have taken steps to provide education in, and information about, relevant telecommunication related technologies to improve their ability to compete globally. Countries that do not adapt to the technological explosion are facing insurmountable difficulties in keeping pace with the rest of the world.*

Human resources in Ibero-America vary in quantity and quality; the use of up-to-date technology can improve productivity when education is successfully enhanced. This education is more effectively implemented when state-of-the-art equipment is available, and technologically advanced tools are incorporated in both training and practice. The "openness" policies which have been established in many of the countries of the region are opening the door for true global interaction, and the tools and equipment needed are now available for those that seek to pursue technical solutions for problems.

ISTEC experience has demonstrated that education, as well as research and development, can be carried out most effectively when cooperation between parties maximizes the effect of scarce resources. This cooperation includes a) the partnership between industry and education, b) the agreements between universities in different countries, c) the interplay between funding organizations and researchers, and d) the interaction among government agencies, industry, and universities.

Obstacles to overcome in promoting the needed interaction include difficulty in obtaining current information for planning and developing technology, scarcity of appropriate expertise, minimal international cooperation in developing the critical mass needed for projects and joint efforts, and a lack of interaction, especially between industry and universities. Efforts must be made to address these issues concurrently to further the needed technological development.

In order to meet these challenges, the Ibero-American Science and Technology Education Consortium (ISTEC) was created in 1990. ISTEC is a non-profit organization comprised of educational, research, and industrial institutions throughout the Americas and the Iberian Peninsula. Current membership includes universities and industries from many countries in the hemisphere, including Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Paraguay, Peru, Spain, Uruguay, Venezuela, and North America.

To address areas of concern, ISTEC members identify specific initiatives which aid the state of technology and education in the region, then work to implement projects within the guidelines of the initiatives. Current initiatives include activities for improvement of libraries and information transfer, continuing education and training, laboratory development and utilization, telecommunications systems, and joint research.

The continuing activities of ISTEC have demonstrated extensive interest in cooperating for improvement of education, research and development, technology transfer, and economic development. The Consortium has successfully implemented a number of projects and initiatives which are improving the quantity and quality of technical education in Ibero-America.

Introduction - Background

During the summer of 1990, personnel from the University of New Mexico visited several institutions in South America to identify and evaluate opportunities for successful collaboration in an international program of scientific education and development. Meetings were held with authorities of various countries, educational institutions, research facilities, and industrial firms, in order to gage interest in establishing a program of innovative cooperation in technical fields. The cooperation in question included hands-on education, research, and technology transfer in state-of-the-art technology and science. The meetings led to the identification of areas of common interest and possible fields of cooperation and research.

This fact finding mission identified a number of characteristics of the state of technology education and research in Latin America:

- Human resources in each country vary in quality and quantity. The more technologically developed countries do have a number of qualified personnel, but in many cases their activities are curtailed by a lack of up-to-date tools. Other countries, because of ongoing economic transitions, are in danger of losing qualified personnel as they seek better economic situations elsewhere. Many of these nations have capable personnel, but need further technical training to bring them up-to-date, and to allow them to contribute to the progress of the country and region.
- In all countries there is a need for more state-of-the-art equipment. In some nations large amounts of effort are invested in creating equipment (albeit good equipment) which could be readily purchased at a reasonable cost. Political realities have not permitted these purchases. Talents and efforts would be better spent in furthering the state-of-the-art, rather than redesigning equipment which could easily be obtained elsewhere. Since the 1990 visit, many countries have made significant strides in this area.
- The visits resulted in an almost universal interest in cooperative activities in innovative hands-on education, research, and access to information. Each university has its own profile of needs and abilities, and is anxious to initiate action to improve technical capabilities.
- Industries and universities which were visited expressed a willingness to participate, and to work with one another. This readiness for joint activities is indicative of the desire of all parties to work together for the good of the country and region, and it should be encouraged to allow the talents of the different groups to be fully utilized.
- The new “openness” policy which has been established in many countries will lead to true global interaction. That is, international firms should be able to participate in joint ventures and other activities and be protected by law. [Sudden “openness” implies the immediate death of many industries; gradual (2 to 5 years) opening seems to be the appropriate mode of operation.]
- The industrial organizations that were visited expressed a common need for hands-on education, research, and access to information and talent. That is, the industries recognized the need to work with universities, but also insisted that the interaction lead to usable ideas, and to solutions of real problems. It is imperative that theory be applied to the needs of the country and region, not solely utilized to generate papers for publication.
- Government resources allocated for upper-level education are limited and must be used wisely. A portion of these resources should be utilized to establish cost-effective mechanisms used for bringing current educators and researchers up to date in their fields. Since these resources are also used for “normal” expenditures in higher education, these resources are thinly spread over all of the schools.
- Due to the improved “openness” and enhanced international cooperation, a variety of opportunities are available for business and investment in Latin America.
- In many of the countries the time has come for industry to change its mode of operation from copying technology to generating and utilizing new technology. This can only be brought about with long term planning for technology, incorporating appropriate research facilities and training sites.

The interactions and activities undertaken in the trip confirmed that there are a great number of bright, dedicated, and highly motivated people in Ibero-America. All parties will benefit from increased technical emphasis, both in education and in creation of market opportunities. These observations resulted in the following recommendations:

- An aggressive and innovative international science and technology mechanism will lead to better technical education in all participating countries and to better business opportunities for new and established industry.

- It is imperative that any organization which carries out high-level educational efforts make direct contact with universities throughout the region. Care must be taken to minimize duplication of efforts and to maximize utilization of scarce resources.
- It is imperative that any organization have access to current technology information in order to be able to be competitive with its use of technology.
- Industries must be actively involved in the educational process, identifying areas of concern for additional training and supporting universities with appropriate projects and equipment. Industry can have a positive influence in bringing together entities with similar interests, joining with universities in an international collaborative effort.
- Governmental support for technical programs in Latin America needs to be encouraged. This includes both programs in the US (and other concerned nations) which offer technical assistance to the region, and programs within the countries which seek to develop and utilize technology. Countries need a sound, aggressive, and flexible policy that promotes science and technology. A number of programs of the international funding agencies provide assistance to countries in Latin American, and these programs must be given emphasis and direction.

Clearly, a concerted effort will be required to enable Ibero-American countries to play an active role in the emerging international market place. In order for a nation or region to achieve world class competitiveness it must utilize all available tools that enhance its human resources and expand the possibilities for an improved economy. This includes gaining private and public access to state-of-the art technology, creating new and modifying existing programs of study in engineering and the sciences, as well as installing new and updating current research and development (R&D) laboratories. It also involves cooperating in joint R&D projects, and facilitating non-traditional exchange of personnel across international and educational boundaries. To keep these activities coordinated, current telecommunication facilities must be improved, permitting real-time access to information and new methods of research and development. Finally, technical training programs must be developed to upgrade the human resource skills which will be utilized to do the work.

Critical obstacles to overcome in carrying out activities required by this update of capabilities include:

a) Lack of current information for planning and developing technology
b) Lack of expertise in the use of information
c) Lack of international cooperation in developing the critical mass needed for projects and joint efforts
d) Lack of interaction (lack of confidence and sometimes lack of information) between universities and industries

The above difficulties are exacerbated by the lack of awareness of the existence and interplay of the above obstacles. It is imperative that efforts be made to address these issues *concurrently* in order to further the technological development of Ibero-America.

The Ibero-American Science and Technology Education Consortium

Subsequent to the fact-finding trip made by the personnel from the University of New Mexico (UNM), an organizational meeting was held for the purpose of addressing the concerns of international technical education and cooperation. At that time the Ibero-American Science and Technology Consortium (ISTEC) was created, bringing together parties from throughout Ibero-America interested in creating mechanisms for enhancing the availability and quality of technology and science.

ISTEC is a non-profit organization comprised of educational, research, and industrial institutions throughout the Americas and the Iberian Peninsula. The Consortium has been established to accelerate development by fostering scientific, engineering, and technology education, to promote joint international research and development efforts among universities, scientific centers and industry, and to provide a cost-effective vehicle for technology transfer.

The objectives of the Consortium are to conceive, plan, and carry out activities of higher education, research and development, and technology transfer, for the purpose of facilitating scientific and technical progress of the Ibero-American countries. ISTEC participants encourage the free flow and access of information in the pursuit of technical excellence. Present emphasis is in the fields of science, engineering, and technology; future extensions into other areas are expected and encouraged.

As described in detail above, availability of technology plays a major role in the development of an area, and so ISTEC members work to form active partnerships between industry and education. This interaction is depicted in Figure 1, which shows direct cooperation between universities and local and multinational industries. This cooperation can take the form of research and development, technology transfer, educational development, and other forms of mutual cooperation. By acting jointly, universities serve the needs of the area by providing appropriate training, while the industries gain access to research and development laboratories with reduced investment requirements.

International cooperation of ISTEC institutions is provided by communication mechanisms established through the Consortium, as shown in Figure 2. Universities and industries which are located in geographically diverse and distant areas can form alliances which share information, personnel, and other resources. These alliances allow

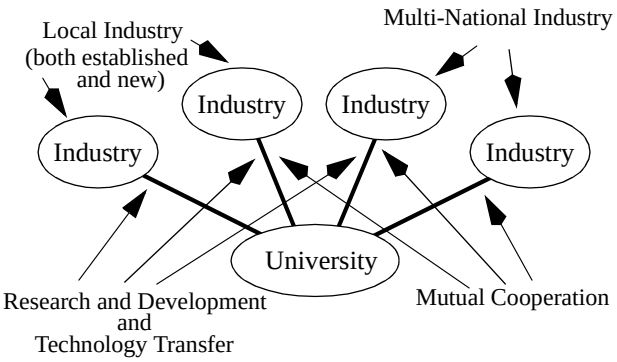

Figure 1. Cooperation of ISTEC Members.

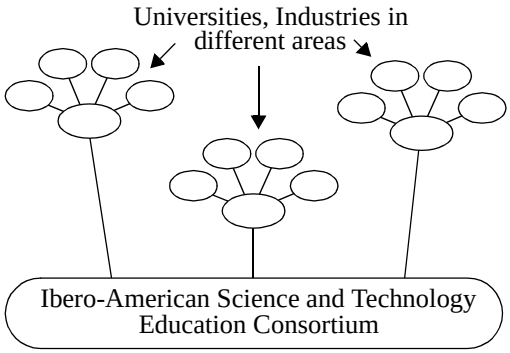

Figure 2: Cooperation through the Consortium.

enhancement of technology and science for all participants, with a corresponding positive effect on the development of the region.

Funding for Consortium administration, project design and execution, and other activities is derived from a number of local, regional and international avenues. Each member contributes to operational expenses through annual membership dues.

ISTEC draws its members from an area which is notable in its diversity, geographically, technically, and educationally. Members from throughout Ibero-America have agreed to a Memorandum of Understanding which establishes an organizational structure which consists of the following entities:

- General Assembly: All members enjoy representation in the General Assembly, the functions of which are to form policy for the Consortium and to direct the activities of the Executive Committee. The General Assembly has the authority to alter the terms of the Memorandum of Understanding, to admit new members, and to allocate dues received.
- Executive Committee: Members are elected by the General Assembly, carry out the policies established by the General Assembly, promote Consortium activities, and have authority to endorse proposals submitted by members. The Executive Committee may also admit new members on a provisional basis.
  The Executive Committee consists of nine to thirteen members, as directed by the General Assembly; one third of the members are chosen from industry and two thirds from educational institutions, drawn from all geographic areas involved with ISTEC as determined by the General Assembly.
- Secretariat: Personnel from appropriate ISTEC member countries administer the day-to-day activities of the Consortium, and also serve as a central source for information and management.

The primary service of the Secretariat is presently being provided by the University of New Mexico, utilizing both the Department of Electrical and Computer Engineering and the Latin American Institute. Other regional Secretariat branches with convenient geographic locations are the Universidad de Vigo (UVI) in Vigo, Spain, and the Universidade Estadual de Campinas (UNICAMP), in Campinas, Brazil.

The administrative costs of the Consortium are financed by member dues, while funding is sought for specific projects which involve members in participating institutions. In addition, the State of New Mexico has financially supported the Secretariat activities at the University of New Mexico. Thus, all members contribute to the overall administration of the organization, while funding sources are sought for implementation of specific projects.

ISTEC Initiatives

The formation of ISTEC allows member institutions to work together to bridge the technological gap and bring Ibero-America into the 21st century. This is being accomplished as members identify specific initiatives which aid the state of technology and education, as well as the development of the region, then work to implement those initiatives.

The Consortium's initiatives are member-driven, flexible, and run concurrently. Within initiatives, projects are identified, planned, and implemented. The distributed structure from which the projects stem actively avoids duplication of efforts and inherently responds to membership needs. ISTEC participants encourage the free flow and access of information in the pursuit of technical excellence. Projects are designed with both short- and long-term goals, as well as consideration of social impact. They are dynamic and expandable, and coordination is encouraged to maximize the utilization of available resources. A number of these initiatives are underway (see companion article), including activities for improvement of libraries, continuing education,

laboratory development, National and Regional Information Infrastructures, and joint research. As these projects grow and evolve, the experience and knowledge will be shared with participating organizations, working to bridge the technology gap and improve developmental conditions.

Projects currently underway include a number of bilateral and multilateral research and development efforts, as well as laboratory and curriculum development. These projects have resulted in creation of telecommunication and microprocessor laboratories in several countries, as well as cooperation in research projects. An extensive publication list of conference papers and journal articles reflects the diversity of the work which has been accomplished by the collaborative efforts of a number of ISTEC institutions.

Conclusion

The interest in international efforts in technical cooperation for academic and developmental activities is evidence of the continued globalization and interdependence of nations. The strength and versatility of a region is dependent upon the ability of the region to adapt and apply new technology to the problems which exist.

The Ibero-American Science and Technology Education Consortium was organized to provide a mechanism for international cooperation in the areas of science and engineering. Participating ISTEC institutions share up-to-date education, transfer of technology, research, and development in areas of mutual concern. Ideas are exchanged, initiatives undertaken, projects developed, and information shared in an atmosphere of trust and integrity. The Consortium is developing common programs in diverse areas, facilitating the transfer of information, expertise, and capabilities.

The activities undertaken by the members of ISTEC will lead to improved technical abilities for all participants. As educational tools and techniques are developed, they are readily transferable to sites with similar programs and equipment. In the area of development, transfer of ideas is facilitated by an established collaborative mechanism and state-of-the-art networking. Members avoid duplication of efforts and share expertise to solve problems in similar areas. These activities are leading to improved technical capabilities for all participants.

It is important that the Consortium develop and maintain interactions with industry. This will provide a connection with the real world, to make sure that the education and development activities are applicable to current needs. Thus, science and technology become tools for the solution of real problems, rather than an end in themselves. The application of technology to existing problems will improve local conditions as well as provide new business opportunities.

Acknowledgments

The existence and growth of the Ibero-American Science and Technology Education Consortium is due to the individual efforts of the dedicated personnel at member institutions. These people continue to invest time and energy in the activities of the Consortium, knowing that this investment will result in improved opportunities for all Ibero-America. Special mention should be made for Motorola Inc., Nortel, and Fluke Inc., who have supported ISTEC activities from the beginning, and Khoral Research, Inc., which has provided a unique software platform for utilization in the Consortium. Support has also come from McBride Inc., IBM-Brazil, Conselho Nacional de Desenvolvimento Cientifico e Tecnologico (CNPq - Brazil), Fundacao de Amparo a Pesquisa do Estado de Sao Paulo (FAPESP - Brazil), Colciencias (Colombia), CICYT (Spain), and Xunta de Galicia (Spain). Finally, the authors are grateful to the State of New Mexico for supporting the activities of the University of New Mexico in its interaction with the Consortium.

Current information about ISTEC can be found at: http://www.eece.unm.edu/istec.