PLENARY SESSION IV
"THE ROLE OF SCIENCE AND TECHNOLOGY IN THE DEVELOPMENT OF MINDANAO"

The Role of Science and Technology in the Development of Mindanao

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ABSTRACT

Mindanao, also called the 'land of promise' is populated by about 15 million people composed of 81 percent Christians, 18 percent Muslims and 13 tribal groups. The paper discusses major plans for the development of this land of promise that is rich in natural resources, large arable tracts of land, and well-educated people. New initiatives brought about by the formation of the BIMP-EAGA and the recently approved designation of Zamboanga City as a Free Port Economic Zone, have brought about new directions for the full and maximum development of the agricultural, financial, and investment sectors in the area. Mindanao has been seen as the country's front door to East Asia and a major player in achieving the government's goal of industrialization by the year 2000. The role of science and technology in the planning and implementation of priority leading edge technologies for Mindanao is discussed. Essentially, two major strategies are envisioned. First, is to institute a vigorous and comprehensive transfer of science and technology and commercialization programs for the sectors chosen as priority projects. The second, is to plan for the ultimate development and training for highly competent skilled and unskilled labor force.

INTRODUCTION

Science and technology are powerful forces in society. Properly planned and executed, the widespread utilization of science and technology can bring about improved socio-economic development. The application and outgrowth of scientific and technological innovations can expand national wealth and individual opportunity, can eliminate spatial and temporal barriers to action, and can contribute to the skills and capabilities of a nation's population.

The administration has set the year 2000 when the Philippines shall attain the status of a newly industrializing country (NIC). In the experience of South Korea, Taiwan, Hong Kong, and Singapore, this state is generally characterized by rapid economic growth. Development in the early 1950s and 1960s has been equated with economic growth, putting a premium on a nation's high level of growth as indicated by its gross national product and per capita income. In the present economic social order, development has been equated with a growing economy paralleled by a reduction or elimination of poverty, inequality, and unemployment. An American economist, Michael Todaro, defines development as *"the process of improving the quality of human lives"*. As the new economic tigers in Asia and the world, Singapore, Korea, and Taiwan have joined the ranks of 'developed nations' and entered the international community with high and sustained economic growth. The application of science and technology that supplied the inventions and innovations in these countries has been the most strategic factor that propelled their take-off to industrialization.

The urgency of applying the fruits of science and technology development to national interest need not be underscored. In the Philippines, no less than two Presidents – President Corazon C. Aquino and President Fidel V. Ramos – have put into place incentives and structures that have profound implications in the rapid development of science and technology. On his first official visit to Mindanao in August 1992, President Fidel V. Ramos indicated that he would transform Mindanao into the country's 'economic growth center'. Both Presidents have equally directed that scientific and technological discoveries and innovations shall be actively applied to backstop economic growth and to improve the quality of life of the Filipino.

BUILDING BLOCKS FOR THE DEVELOPMENT OF MINDANAO

Mindanao has been called the 'land of promise'. It is populated by about 14.8 million Filipinos composed of 18 percent Muslims, 81 percent Christians, and 13 tribal groups. The soil is fertile and the region has been spared of typhoons and floods. It is the only region in the country with numerous natural resources, large arable tracts of land, and well-educated people. It is also in Mindanao where one can find rich nickel and iron deposits; the latter account for three-fourths of the country's iron reserves. Large coal deposits can be found in the northern coast producing sintered iron and steel plates. Mindanao also hoards a third of the nation's coal reserves and two-thirds of the entire island are still covered with forests. Agriculture is very

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pronounced with large multinational corporations like Dole, Del Monte, and United Export companies operating and accounting for about 33 percent of the country's agriculture exports of bananas, pineapple, and tuna. New high-value crops are being produced such as asparagus, tomatoes, onions, mushrooms, and cut flowers. No less than President Fidel V. Ramos has consistently named Mindanao as the country's front door to East Asia, and more importantly, a major player in achieving the government's goal of industrialization by the year 2000. This call was strengthened by his creation of a presidential field office in Mindanao and the appointment of Paul G. Dominguez as Presidential Assistant for Mindanao.

The BIMP-EAGA Growth Triangle

Mindanao has been in the front page news lately not only because of the peace talks between Nur Misuari and the government panel or the peace and order problems brought about by the extremist groups of Abu Sayaf and the MILF. Mindanao has now become known as a new 'battleground' for investors because of the new initiatives brought about by the formation of the **BIMP-EAGA,** the first building block, that would pave the way for the rapid development of Mindanao. BIMP-EAGA stands for Brunei-Indonesia-Malaysia-Philippines East Asia Growth Area, a spin off from the ASEAN free trade zone. Besides Mindanao, EAGA also comprises the subnational economies of East Indonesia, East Malaysia, and Palawan. The East Asia Growth Area proposes increased economic linkages between member countries and this has served as a take-off point for the full development of business potential in the area.

As a starter, the Philippines is fast tracking the creation of the $300 million BIMP-EAGA Growth Fund in time for its programmed launching by the fourth quarter of this year. The proposed fund is envisioned to serve as a catalyst for the progressive development of approved EAGA projects for Mindanao. The investigative study of the Asian Development Bank has identified 25 priority projects to be pursued by this new geo-economic grouping. Four areas have been identified for immediate implementation of cooperative ventures between the BIMP-EAGA member countries. They include the (1) expansion of air linkages, (2) expansion of sea linkages, (3) expansion of fisheries cooperation, and (4) joint tourism development. The short-term plans for immediate implementation would include the: (1) promotion of the EAGA sub-region as an eco-tourism destination; (2) promotion of the EAGA region as a center for agri-processing; and (3) increase in the level of formal trade within the EAGA member countries.

Mindanao is pursuing two key development strategies in this regard. The first strategy is to bring about the full physical integration of the cities and provinces in Mindanao. Infrastructure projects are in the pipeline to link the region's 15 million people into a vibrant economic unit and an attractive consumer market. The second strategy is to strengthen the island's trade and economic links through the EAGA concept.

Several initiatives have already started in the areas of air and sea linkages, transport and shipping services, fisheries cooperation and tourism development. The expansion of Zamboanga port as a possible cruise destination along with neighboring East Malaysian states of Sabah, Sarawak, and Brunei is a major project identified by an ADB study that will propel the progressive development of the EAGA areas. The completion of the Mindanao arterial road network earmarked at P2.9 billion, involves the upgrading of 11 road networks. Plans are underway to complete a six-lane expressway to link Davao City with Cagayan de Oro and arterial road network to connect airports, seaports, and large cities in Mindanao. This alone will provide access to agricultural, aquaculture, and other products and linkage between the cities and provinces throughout the island. The upgrading of the airport in Puerto Princesa has already commenced for the promotion of eco-tourism since the area is endowed with rich natural resources. With funding assistance from US AID, expansion and modernization of Mindanao's seaport in Makar into a full containerized port, is now in full swing. Another fishing port being developed in General Santos City is under the P589 million project funded by Japan's Overseas Economic Cooperation Fund. The Davao International Airport featuring a runway extension of 3,000 meters is also due for completion this year.

Sometime in March this year, the Mindanao Business Council, together with rural bankers and government and non-government leaders jointly signed a memorandum of support to establish a 100 million dollar Mindanao Fund. This would serve as capital for Mindanao-based enterprises to expand their businesses and effectively respond to the growing economic opportunities in the area. To be officially known as the Growth with Equity in Mindanao program (GEM), it will fund priority projects in infrastructure, telecommunication, tourism, agribusiness, mariculture, financial services, and building materials. Presidential Assistant for Mindanao Paul G. Dominguez announced that the GEM Fund will provide a mechanism where projects for investment in Mindanao can be linked with strategic joint venture partners and extending to them technology transfer assistance. In this way, the Mindanao business community, government and non- government organizations, and local and foreign investors can pool their resources and invest in projects and business activities that are within the BIMP-EAGA initiative.

The Zamboanga Special Economic Zone and Free Port

The second building block that would spearhead the rapid development of Mindanao is the recently approved designation of Zamboanga City as a Free-Port Economic Zone. Originally proposed in 1992 and authored by the Honorable Congresswoman Maria Clara L. Lobregat, Republic Act No. 7903 was signed into law by President Fidel V. Ramos on February 23, 1995. This bill, entitled **An Act Creating a Special Economic Zone and Free Port in the City of Zamboanga** will lay the groundwork for the development of the city and Mindanao. In January of this year, Zamboanga City began to operate as a Special Economic Zone and Free Port with the appointment of Former Mayor Manuel Dalipe as Chairman of the Zone.

Among the provisions of the bill is the declared policy of government to encourage and promote a balanced industrial, economic, and social development through the maximum participation of the local and foreign private business enterprises and sectors. The bill states that the government will endeavor to provide incentives for local and foreign investors, generate employment opportunities, and encourage regional dispersal of industries. In other parts of Mindanao, foreign investors are already being courted, given incentives in the form of tax holidays and exemptions from other taxes. These and more are being considered for the Zamboanga Eco-Zone. Another provision describes the zone as a decentralized self-reliant and self-sustaining agro-industrial, commercial, financial, investment, and tourism center complete with suitable, residential and retirement areas for local and expatriate employees. In this regard, transportation, telecommunications, and other facilities would be set up to attract legitimate and productive foreign investments and to generate linkage industries within and outside of the region.

Based on its location, the city of Zamboanga is the nearest port to most of the ASEAN countries. In addition to this, Zamboanga City has long engaged in 'barter trading' with Sabah, Kalimantan, and other neighboring countries in the area. Barter Trading boomed after 1974 when the Philippines and Malaysian signed a formal agreement to cover trade between Labuan and Zamboanga City. This trading business hit a high peak in the 1980s with about 2 million dollars of goods being exchanged between Filipinos traders and Labuan businessman at any one time.

Zamboanga City as a free port and special economic zone would also be conducive to be developed as a financial center similar to that of Labuan, Malaysia. Senator Raul Roco has already introduced in the Senate certain features of Hong Kong commerce that can be applied to Zamboanga City, in order to attract and provide a favorable business climate for potential investors. By liberalizing the conduct of banking and finance, there would be a stronger linkage between local and foreign investors and will facilitate the flow of foreign savings. Capital and banking services needed to develop the growth area are to be made available. Efforts will also be made to facilitate the movement of people within the EAGA member countries, facilitate the exchange of advisers and experts and technicians, and to minimize or remove legal constraints and administrative barriers to trading, business, and economic opportunities between member countries.

Need for Infrastructure Support Facilities

Zamboanga City, as a Free Port and Special Economic Zone, would need massive development and construction of several infrastructure support facilities.

1. *Improvement of Seaport Facilities.* The present seaport facility can be converted to become a main cargo port for tourists and local travel. A new seaport has to be constructed to accommodate cargo port handling, warehouses, tank farms, containerized and bulk loading facilities, and transshipment facilities. For this development, there will be a need to raise up to 500 million dollars.

2. *Improvement of Airport Facilities.* The present airport needs to be improved to accommodate the incoming flights of bigger airplanes such as the airbus and Boeing 747's. One alternative is to extend the present runway by about 600 to 800 meters. The other is to build a new airport in the East Coast where land is available to receive bigger planes, transporting in and bringing out export products like cut flowers, fruits and vegetables, fish and seafood products. The new airport will also house fueling facilities, domestic flight operations, refrigeration and handling facilities, and maintenance units. The old airport can be converted into a new commercial-industrial center and be developed to become a premiere commercial center of the city. A budget of about 50 to 200 million dollars for a modern and complete airport facility will be needed.

3. *Conversion of the Present Airport to a Commercial Center.* If a new airport is constructed and becomes operational, the present airport could be converted into a new commercial-industrial center. This will help pay for the new airport facility. The construction and development of the new airport and seaport will accelerate development in the west and east coasts and decongest the city proper. The opening up of the city to the west by closing the old airport and the east by the new seaport, will accelerate development in both directions of the city.

4. *Construction of New Roads.* As development outside of the city continues, new roads need to be constructed. Aside from the main highway roads linking Zamboanga City to other cities and provinces, arterial road networks are required to connect the centers to the new ports and the new developed areas in the east and west coast. An arterial network of roads in the city connecting the new center to the new ports and the newly developed areas in the east and the west will require an investment of about $250 million.

5. *Development of Communication Facilities.* Development of communication facilities will need top priority in the development of the Zamboanga Free Port and Economic Zone. Improvement of the present telecommunication structures need to be made a priority for the PLDT. Telephone direct dialing, international direct dialing, and Fax machine facilities are very much a necessity for investors and business transactions. The same goes true for cellular telephones and electronic mail.

6. *Improvement of Power Supply.* The next important infrastructure project is also power supply. Energy and information are the wheels of trade and business and therefore require major considerations in the overall development plan. On this requirement, Napocor President Guido Delgado signed a contract with local government officials, for the construction and establishment of a P2.8 billion pesos power plant that will provide ample power supply for Zamboanga City and the nearby provinces. The contract, signed on March 28, 1996 calls for the construction of a 10 megawatt diesel power plant worth $110 million. Similar power plants are scheduled to be established in General Santos City, Mt. Apo, Davao, Iligan City, and Misamis Oriental.

7. *Development of Sub-Industrial Estates.* The next area to be considered is the construction and development of sub-industrial subdivision estates for employees and expatriate workers, businessmen, and investors. The estate would have housing projects, shopping centers, recreational facilities, schools, churches, parks, and other amenities conducive for living in the Eco-Zone.

8. *Development of Agri-Estates.* The Eco-Zone should also consider the development of large-scale agri-estates, which are compatible with small scale individual activities similar to the Comprehensive Agrarian Reform Program. Such estates should engage only in processing agricultural output or adopt program activities involving high-value exportable crops.

SCIENCE AND TECHNOLOGY AND THE BIMP-EAGA

For the people in Mindanao, the BIMP-EAGA initiative and the development programs and economic projects that it will bring, are expected to alleviate poverty, provide the people with basic services, and improve the quality of life in the urban centers and in the rural areas. The development programs and activities are also designed to make an impact on the national economy of the country as a whole. The areas and potential fields of cooperation between the EAGA member countries include the following: (1) Transportation and shipping services, (2) Fisheries, (3) Tourism development, (4) Agriculture and horticulture, (5) Energy exploration and development, (6) Environmental protection and management, (7) Forestry and timber products, (8) Human resources development, (9) Industry, (10) Institutional arrangements, (11) Infrastructure links, (12) Natural resources development, (13) Services, and (14) Trade and investment.

For a start, the development efforts earmarked for the EAGA projects should include the planning and implementation of priority leading-edge technologies in the following sectors: Agriculture and Food Production, Information Technology, Electronics, and Eco-tourism. In all of these enterprises and ventures, human resource utilization and development are of the highest importance and would need priority status. Local and foreign investments in the above sectors would necessarily need labor and manpower with the appropriate skills and technical training for companies to operate. It has been shown that increase in economic productivity can come as a result of four crucial factors: (1) improved labor quality of which education is the key element; (2) reallocation of resources from less to more productive sectors; (3) better economies for scale; and (4) technological changes or advances in knowledge resulting in better methods of production. To provide a solid base for science and technology implementation, Mindanao needs a highly trained skilled and unskilled work force to respond to the requirements of the different sectors of the economy that would come as a result of the EAGA initiative and the Free Port Economic Zone. Two major strategies can be pursued. The first one is to institute a vigorous and comprehensive transfer of science and technology and commercialization programs for the sectors mentioned. The second strategy is to plan for the ulti-

mate development and training for highly competent skilled and unskilled labor force.

Strategy 1. Comprehensive Transfer of Science and Technology

Mindanao must pursue development foremost in the areas of agriculture, aquaculture, food processing, and forestry. The Region must first attain self-sufficiency in food production before it can compete in the foreign market. There should be a strong move to strengthen the domestic economy and to impose drastic agricultural reforms. Major reforms and strategies should be envisioned to increase productivity in rice, corn, livestock, forestry, and fishery products. The competitiveness of the Region's agricultural products can only come by modernizing farming methods and by shifting traditional methods of farming into a more scientific and entrepreneurial approach. Efforts should be made to provide incentives and technical assistance to small entrepreneurs and cooperatives. Small and medium scale technology ventures should be sustained with adequate training and support given for the adoption and further development of technologies that would benefit agricultural production.

At the same time however, Mindanao must not lose sight of its ultimate target and that is to ultimately produce surplus exports and increase dollar earnings. One of the most profitable areas now is in electronics, communications, and information technology. The short term goal in communications technology is to make every Filipino household a part of the information superhighway. Home computing will be an increasing market and the internet is fast gaining acceptance in the Region. The competitive advantage by which commercial and business applications can be gained through the use of digital technology can be complex but dynamic. The internet highway is just but one of the communications technology that home users, agricultural technicians, local government people, the business environment, students, academicians could benefit from. The returns in investment can be fully maximized with effective use of digital communications. The privatization of the telecommunications industry has already created a competitive marketplace with many investors entering the market.

In the coming decade, the demand for electronic and telecommunication services will increase not only for the world market business but more so in deciding what products and services would be most profitable for the continued development of Mindanao. As mentioned once by Science Secretary William G. Padolina, 'We must concentrate on developing emerging technologies such as laser technology, photonics technology, information technology including software development, biotechnology, microelectronics, genetic engineering, material science, and information networking'. Mindanao can have the technology capability to design and develop the software and hardware to support this telecommunication infrastructure. In due time, when the local needs have been satisfied, Mindanao can supply the global market with the same telecommunication high-technology products. In this regard, Mindanao needs the assistance of the Department of Science and Technol-

ogy and other line agencies to help it achieve a full and effective transfer of technology to speed up the development of priority projects.

Another dollar earner activity for Mindanao is in the promotion of eco-tourism. Mindanao abounds with forest sanctuaries, coastal zones and beaches, mineral grounds, and a rich indigenous cultural heritage that can offer extensive opportunities for tourist attraction. At the same time that agriculture is being modernized to include the application of technological innovations, sustainable agriculture should also be pursued even only in selected sites and areas. Sustainable agriculture does not mean a return to primitive traditional methods of agricultural production. It is a combination of traditional conservation methods with sustainable systems of equipment and procedures. Thus, strategies for a sustainable form of agricultural development must also be underscored. Eco-tourism can be pursued in earnest, but in the course of its development it should include at the same time conservation, protection, and rational use of the island's natural resources. It is essential for policy makers, businessmen, and consumers to take note that if we are to achieve a life of dignity and if the welfare of present and future generations is to be assured, environmental protection should be mutually compatible with economic growth. This implies that economic and developmental growth objectives should not only be for the good of society, but also for the natural dynamics and carrying capacities of the environmental eco-systems.

The development of trade in the BIMP-EAGA region, especially through the ports and commercial centers will boost the tourism sector. The present tourist attractions of Zamboanga City are the golf courses and beach areas. The development in the west coast also make the La Paz and Camp Susana areas potential tourist attractions. With proper development and planning, these two places can be converted into tourist places comparable to if not better than that of Baguio City. Also high on the priority list, is the development of the two Sta Cruz islands which are noted for their pink sand beaches and colorful underwater coral reefs. In the east coast, resorts spanning the coastline of Bolong to Vitali and Taluksangay can be made attractive for tourists. The places are not only noted for their wide beaches but also for their ethnic cultural and historical artifacts and collections.

Strategy 2. High-Level, Skilled and Unskilled Manpower Development

One serious problem that would hinder the growth of any emerging economy is the lack of manpower with the right skills needed to staff the different sectors in agriculture, food processing, information technology, electronics, and eco-tourism. We have too many university graduates who are either unemployed or underemployed as a result of a mismatch of training and job opportunities. Attitudes towards the type of job to be taken can also be a major problem as many of our graduates opt for 'white collar jobs' that are not available. In contrast, there are many opportunities that are left unfilled in the agricultural, industrial, and technical sectors due to lack of manpower with technical skills. To develop and expand our industries in Mindanao, we would need trained skilled workers for they are the backbone of the

different industries that would propel the full development of the area. In many instances, we lose our skilled workers to industrialized countries who offer them better incentives than what they can get in our own country. We should be able to train and retain our skilled and unskilled manpower. To enhance and complement the capabilities of the labor force in the application and promotion of science and technology, several measures should be adopted. For instance, there should be a greater emphasis on human resources development in relevant science and technology areas. Authorities at the Zamboanga Eco-Zone must be able to identify, plan, and provide the products and services most needed and wanted by investors. There must be an in-depth survey of the products and services that would be in demand by local and foreign investors. An inventory of resources and the markets for these will have to be specified. An inventory data bank of manpower resources to indicate what we have and what local and foreign investors need is extremely essential. Continuing training programs on technology and research management should be planned for major program sectors. Research and product evaluation should be intensified to improve labor efficiency and productivity. Global competitiveness can only be attained when quality products are at par with products produced in other countries. In this regard, institutions like State Colleges and Universities should strengthen partnership with the private sector, non-governmental organizations, private colleges and universities, and other relevant government agencies to rationalize course offerings, programs, and resource training initiatives. Inter-sectoral discussions, collaboration, and partnership in providing the most effective and relevant human resource training could be pursued in the areas of networking, information exchange, technology promotion, technology assessment and transfer, and marketing of products to the different parts of the region. In this connection also, Mindanao will continue to seek the assistance of the Department of Science and Technology to provide the necessary support in modernizing and implementing massive technology transfer mechanisms from local and foreign sources in program sectors where S&T are mostly required. Support in manpower development and the development of a science and technology culture among students and teachers would also be needed.

To keep afloat in the 21st century, Mindanao must come up with a comprehensive, systematic, and well-coordinated human resources development plan for its sectoral programs. What we have today are individual and oftentimes uncoordinated policies for Human Resource Development from various sectors. HRD in Mindanao should not only be geared to prepare the people for the influx of economic, trade, and networking development trends as a result of the BIMP-EAGA and the Free Port Economic Zone initiatives. Human Resource Development should go beyond and prepare for the consequences of the transfer of science and technology and its effects on the labor force. Three strategies can be undertaken. First, Mindanao should look at its educational system. Improvements should be made on the factors that affect the provision of relevant quality education in the basic, secondary, and tertiary levels. Incentives for teachers and university academ-

ics, circular reforms, provisions of instructional materials and textbooks, decreasing the present teacher-student ratio in the classroom, subsidies to private institutions, and many other factors should be examined and improvements instituted. Second, continuing professional and technical education and training must be planned for skilled and unskilled workers. Management personnel and technical staff need to be continuously re-trained and re-tooled with the necessary knowledge, competencies, and skills in keeping up with the rapid changes in technology production and marketing economy. Third, there must be a change in the attitude of the people to desire education and training in science and technology courses as well as in skilled courses in manufacturing, construction, communications technology, electronics, and transportation. Historian Paul Kennedy in his book **Preparing for the 21st Century,** mentioned that Japan, South Korea, Germany, the Scandinavian states, and the European Community as a whole are the countries most likely to succeed in the 21st century. The reasons for this assessment are obvious. These countries have a high savings rate per family in the population; public and private levels of investment in new plants and equipment are impressive; and most of all they have an *"excellent educational system, a skilled workforce, good re-training systems and a work culture"* that is most enviable. Ultimately, with an efficient and hard-working skilled and unskilled labor force, Mindanao could adopt a technology-based economic growth similar to the path successfully taken by Singapore and Taiwan. Both countries were successful at developing their technological capabilities because they invested heavily in both education and research and development projects. Also, foreign investors, small and medium scale entrepreneurs, and the private sector were attracted to the incentive structure and environment put up by government for business to prosper.

In due time, Mindanao could create a sustainable competitive advantage of its products and services through the build-up of technological capabilities as a result of an effective manpower labor force. As Paul G. Dominguez, the Presidential Assistant for Mindanao, once remarked, "The best has come to Mindanao and the island will be prepared for it". With proper planning and implementation of target plans plus support of the government and private sectors, Mindanao can be transformed from a *"supplier of raw materials that it had been for so many decades, into a balanced agro-industrial and service-based economy"*. There is a strong future ahead for Zamboanga City and Mindanao in general, but nobody is going to pick up the cudgels for development except its people. Working together in unity, with utmost personal freedom and social responsibility to put matters in the right perspective sans greed and selfishness, the development of Mindanao can be attained to the fullest.

REFERENCES

Bomeisl, R. 1995. Building blocks for Zamboanga's development. *Ateneo de Zamboanga Journal* 1(1):46-55.

Bomeisl. R. 1995. Energizing the Zamboanga special economic zone and free port. *Ateneo de Zamboanga Journal* 1(2):52-59.

Magic in Mindanao. *Asiaweek,* December 1992.

Salgado, G. 1995. The human factor in development of Philippines 2000: An assessment of the economic programs of the Ramos government. *Lectern MSU-IIT* 2(11)1-8.

Todaro, M. 1985. Economic Development in the Third World. 3rd edition. Longman, New York.

Panelists

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At the outset, allow me to congratulate Fr. Bomeisl and Dr. Alvarez for the excellent paper on the Role of Science and Technology in the Development of Mindanao. The paper has presented in a very clear way the current infrastructure developments in Mindanao, the role of the East-Asia Growth Area (EAGA) and the expected inputs of the Department of Science and Technology that will accelerate the technological development of Mindanao.

As pointed out in the paper, the potential areas of cooperation among the EAGA member countries encompass the following: Transportation and shipping services, Fisheries, Tourism development, Agriculture and Horticulture, Energy exploration and development, Environmental protection and management, Forestry and timber products, Human resource development, Industry, Institutional arrangements, Infrastructure links, Natural resources development, Services, and Trade and Investment. However, the authors propose that priority be focused on technologies relating to agriculture and food production, information technology, electronics, and eco-tourism.

A. Areas for Development

I can not disagree with the suggestions of the authors for indeed these sectors may be considered as sunrise sectors which can enhance Mindanao's production of globally marketable products and services. For instances, Mindanao has tremendous food resources which, properly processed according to international standards, can penetrate the wide markets in various parts of the world. In fruits alone, Mindanao produces not only one of the best pineapples in the world. It also produces exotic fruits such as durian and rambutan which can be easily marketed in the Middle East and European Countries; both in their natural and processed forms.

The abundance of fish and other aquatic products is also a distinct advantage of Mindanao. Increasing the production of these commodities will not only meet the demands for domestic consumption but also that of export requirements.

B. Investments Level

It will be noted that there are substantial investments in the region for 1993 and 1994 as shown in the following table:

BOI-approved New and Expansion Projects
Regional Distribution, 1994/1993

	Value of Investments (in billion pesos)	
Region	1994	1993
9	10,733.1	332.0
10	15,671.1	21,287.0
11	4,477.8	4,647.0
12	6,371.1	–
TOTAL	37,253.1	26,266.0

Source: 1994 Annual Report, Department of Trade and Industry.

C. Technology Transfer Programs

The authors propose that DOST assist in technology transfer activities as well as in providing support for human resource development. As many of you are already aware, the DOST has a number of programs which are intended to hasten technology transfer with the active collaboration of experts from the academic institutions and the private sector as well. These programs include the following: the Manufacturing Productivity Extension for Export Promotion Program (MPEX) assists small and medium enterprises (SMEs) in the manufacturing sector to attain higher productivity and the Municipal Science and Technology Advisory Program (MSTAP) aims to promote technology-based enterprise development in the countryside by tapping academic institutions in the delivery of technology assistance. The Department of Science and Technology (DOST) through the Technology Application and Promotion Institute (TAPI) provides funds to cover travel and other incidental expenses of experts from selected colleges and universities, and the Science and Technology Experts Volunteer Pool (STEVP) brings the scientists to where they are needed – the countryside. The services of experts are made available for free for very short term technical assistance to cooperatives, NGOs, and other interested parties.

D. Technology Transfer Projects

It will also be observed that for Region IX technology transfer projects include the following: marble processing, rice hull combustor, multicrop solar drier, coconut oil processing, woodwool cement board, and coconut processing. For Re-

gion X, the following projects were implemented: ceramics production, banana processing, furniture development, metals development, marine fisheries development, brick making, laundry soap making, production of energy from non-conventional sources, shrimp and prawn waste processing, production of equipment for gems and gemstone and fashion jewelry, production of industrial ceramics, rubber wood processing, production of cutflowers through tissue culture, rapid composting (organic fertilizer production). For Region XI, the following projects are being implemented: mango processing, gemstone processing, coconut coir production, utilization or convertion of municipal waste, pearl production, structural bricks production, coco coir production, ceramics production, woodwool cement board production, meat and fish processing, coconut veneer production, and seaweed production for phycocolloid extraction. For region XII, the projects involved are: gemstone cutting and processing, integrated coconut precessing, biomass tissue culture. For Region XIII, the following projects are being implemented: aquaculture and prawn hatchery, beads jewelry production, dimension stone production, butterfly rearing, and multi coconut product processing, and technology for waste management.

Majority of the projects are agriculture-based. Thus, there is a need to develop projects which are along high technology areas such as information technology and biotechnology. In addition, projects of industrial nature have to be encouraged to enable Mindanao to fast-track its progress.

Officers of our Provincial Science and Technology Centers who have been collaborating with the different agencies and institutions in Mindanao are quite active in technology transfer activities. However, because of limited personnel, only one officer is assigned in each province. We believe that a closer relationship among the private sector, the academe, and the NGOs in technology transfer activities will hasten economic development. We, therefore, urge you to collaborate with our PSTC officers so that your needs can be addressed by the regional offices and the central office of DOST.

E. Human Resource Development

You may wish to know that in so far as human resource development is concerned, the DOST is implementing the Engineering and Science Education Project (ESEP) which hopes to produce 3,000 graduate and post graduate scientists and researchers by the year 1998.

In addition, the various training programs and scholarships supported by the Philippine Council for Advanced Science and Technology Research and Development (PCASTRD), Philippine Council for Industry Energy Research and Development (PCIERD), Philippine Council for Health Research and Development (PCHRD), Philippine Council for Agricultural Resources Research and Development (PCARRD), and Philippine Council for Aquatic and Marine Research and Development (PCAMRD) hope to augment the supply of scientists and technologists. As of December 1995, these councils had supported 135 scholars and 1,953 trainees. The Science Education Institute also supports 3,500 scholars at the tertiary level who

come from the poor families nationwide. Similarly, it also funds and extends technical assistance in the training of teachers in science and mathematics through the Regional Science Training Centers (RSTCs).

There is now pending in Congress, a bill that will increase the funding for S&T Scholarships for the poor but deserving young Filipinos who are in the top five percent in their class and who pass a national competitive examination. It is our hope that this bill will be passed this year so that we can increase the number of young scientists in the country. To date, there are 1,116 scholars from Mindanao who have successfully hurdled the competitive examinations and who are now enrolled in technical and other courses leading to a diploma or to a bachelor's degree in science, mathematics, or engineering.

As you will observe, there are many Centers of Excellence in Mindanao and they are staffed with very competent faculty members. Nevertheless, there is a need to continuously upgrade the capability of the faculty and these institutions through the installation of the most modern laboratory facilities so that the education of the scientists and technologists will take place in an environment conducive to scientific learning.

You may wish to consider that Mindanao can be the site of centers of excellence to enhance the educational advancement in science and technology of students from the EAGA countries. We feel that certain institutions in Mindanao can already fulfill this important role for some of them are already known internationally and have produced very good scholars and scientists.

The authors propose that DOST support massive technology transfer activities from local and foreign sources. Such support is already available under the Global Technology Search Program.

We encourage you to consider utilizing this window of opportunity for very focused technologies that you think will be useful in the development of Mindanao. We will be more than happy to assist deserving applicants who comply with the criteria of DOST.

We hope that the assistance in the future will be focused more on the increased production capability of Mindanao in food processing, information technology, materials science, and biotechnology. There are major programs of DOST in these areas including research and development projects. We hope that you can consider this in the development of your research and development plans and technology transfer activities.

As we look forward to the 21st century, we need to go beyond the shores of the Philippines and see Mindanao's role as the Center of Learning for the EAGA countries. We can be truly proud of our talented faculty members, our energetic private sector, and our open culture which welcomes all creeds and nations with a hospitable perspective. We are aware that we have a tremendous capacity for teaching and reaching out to other peoples of the world; that we know how to interface with peoples of various persuasions and beliefs; that we are adaptive and flexible and can succeed in the most adverse and most favorable environments.

Finally, may I extend my best wishes and congratulations to the academicians and scientists who are now meeting in Davao City. We believe that your meeting will be productive and will have quality recommendations and decisions which DOST can consider.

Thank you and good day!

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At the outset, I would like to greet the paper presenters, my fellow panelists, the academicians, scientists, and all those present with the universal greeting peace, *Assalamu Alaikum warakmatullahi walbarakat.* I would also like to thank the National Academy of Science and Technology for inviting us from the Mindanao State University-Tawi-Tawi College of Technology and Oceanography to participate in its 18th Annual Scientific Meeting. It is just unfortunate that the original panelist, our Chancellor, Prof. Eddie M. Alih, is now in the Middle East countries together with our honorable Congressman Nur G. Jaafar trying to solicit funds to finance the development plan of the Southern Philippines Center of Islamic Studies, a center which I established during my incumbency as Chancellor. I would like to speak briefly about the MSU-TCTO, its mandate and role in science and technology and in promoting peace and understanding between Muslims and Christians.

First, I would like to congratulate Fr. Bomeisl and Dr. Anicia A. Alvarez for coming up with an excellent paper on the role of science and technology in the development of Mindanao. As a reaction to the paper, I would like to suggest a more focused dimension to the two strategies they recommended, that is, that the investment of the country's limited resources should be in the development of technologies in carefully selected resource-rich areas. This strategy for localization and specialization was adopted in Korea in its process of industrialization.

While the DOST considers this as one of its mandates, one of the major setbacks of S&T, not only in Mindanao but throughout the country, is that the S&T development plan has not been backstopped by sound legislations and sufficient funding. Direct appropriation to S&T is less than 1% of the Gross National Product in contrast with other countries which earmark 3-5% of the GNP to this priority agenda of development. Table 1 shows the national scenario and the figures may even be lower for Mindanao.

Table 1. Regional S&T operations (in thousand pesos)

Regions	93	94	95	96	Total
IX	6,302	5,002	5,490	7,205	17,517
X	8,024	4,741	6,506	9,362	20,609
XI	7,305	4,661	4,209	11,452	20,322
XII	6,316	3,901	6,474	5,895	16,270
Sub-Total	27,947	18,305	22,679	33,734	74,718
Total	96,065	57,872	71,176	111,216	240,264
Percentage	29.1	31.6	31.9	30.3	31.1

Likewise the funds intended for assistance to science and technology research and development are very limited. Moreover, this allotment includes expenditures such as salaries of regular staff, not necessarily research staff, and maintenance and other operating expenses. These funds are used more for maintenance of the office rather than for funding research activities so that very little impact can be achieved in R&D. Distribution of the allocation for science and technology assistance to the four regions in Mindanao is shown in Table 2. The appropriation for science and technology in the Autonomous Region for Muslim Mindanao is incorporated in the Office of the Regional Governor.

Table 2. Assistance to science and technology R&D (in thousand pesos)

Regions	93*	94	95	96	Total
IX		3,211	4,914	6,157	14,282
X		3,883	5,620	7,151	16,654
XI		3,465	5,204	7,875	16,545
XII		3,147	4,851	6,130	14,128
Sub-Total		13,706	20,589	27,314	61,609
Total		46,970	70,925	92,889	210,784
Percentage		29.2	29.1	29.4	29.23

*No figures were given in the original paper.

There is therefore a need to provide S&T with aggressive policies and legislative action. One of these is the establishment of specialized research centers in Mindanao for carefully screened resources abundant in the area and with high commercial importance. There will be not only adaption of existing technologies to this need but also generation of new technologies. These centers will provide an

avenue for synergy of efforts/teamwork among scientists. By giving full support to these specialized research centers engaged in R&D activities and technology generation for industrial and other applications, Mindanao will be able to meet the challenge in providing the lead for the BIMP-EAGA region in agro-industry, construction and construction materials, and fisheries cooperation, the thrusts of Mindanao in the newly created growth area.

These designated research organizations should be given high priority for investment in facilities and manpower development. In support of this move, a pool of creative scientists and high caliber technologists should be nurtured. Such is the role of DOST with its sectoral councils, such as the ESEP, PCAMRD, PCASTRD, PCIERD, etc., in nurturing young scientists for key roles in the academe, in industry, government agencies, and research organizations. The DOST has embarked on an aggressive program to develop a critical mass of R&D scientists and researchers for the country and a large number of these potential scientists come from Mindanao with the hope that they will return to Mindanao. However, if the research facilities and opportunities for advancement in their chosen fields will not be available, these scholars will seek better opportunities abroad, resulting in brain drain.

While state universities and colleges have a critical role for the development and training of a highly competent skilled and unskilled labor force and more importantly, contribute to R&D, they are unfortunately provided with insufficient funds. Much as they would want to pursue the goals of supporting the science and technology development thrusts of the national government, their research services funds are inadequate or even wanting as shown in Table 3.

In Region IX out of six SUCs, only three have funds for research services but these allotments are not purely direct cost to research but include personal services and other maintenance and other operating expenses. Actually, a very small portion of the research funds goes to the direct cost of research. The same is true with the other SUCs in Regions X, XI, and XII.

To remedy this situation, one such specialized center has been proposed by Dr. Nemesio Montano and Dr. Gavino Trono, noted seaweeds scientists from the UP Marine Science Institute, namely, the Seaweed Research and Development Center. This should be established preferably in Bongao, Tawi-Tawi which is the primary producer of eucheuma seaweeds, the source of carrageenan, a phycocolloid widely used in the food and pharmaceutical industries. This center shall include a seaweeds seedling bank in order to maintain in culture under strict laboratory conditions the best strains of economically important seaweeds thereby ensuring the best quality carrageenan-producing strains. Another component is the seaweeds quality control laboratory designed to monitor the quality of seaweeds used as raw material for carrageenan extraction. With the acceptance by the European Economic Community of Philippine National Grade (PNG) carrageenan as food additive, there will surely be an increase in demand for this source of this phycocolloid. Similar specialized research centers for rubber, tuna, cassava, and exotic fruits should likewise be established in strategic areas.

Table 3. Investment in research services among SUCs (in thousand pesos)

Regions	93	94	95	96	Total
REGION IX					
WMSU	714	791	1356	1759	4620
TCTO	2233	2235	2262	2615	9344
ZSCMS	467	520	1320	1197	3504
BSC			50	80	130
SSC			50	50	100
TRAC			50	50	100
REGION X					
CMSU	1512	3109	2397	3504	10522
MPSCT	468	467	1004	631	2570
BSC			50	86	136
NORMIST			50	112	162
MOSCAT			50	50	100
REGION XI					
USP	1137	1008	929	1146	4220
DOSCT			50	315	365
SPAMST			50	65	115
REGION XII					
MSU	10321	12321	11123	17219	50984
MSU-IIT	2229	2351	7655	4354	16589
USM	6646	6618	6655	7322	27241
CCSPC			50	50	100
CFCST			50	50	100
SKPSC			50	50	100

The Mindanao State University System, for example, in support of the Science and Technology Agenda for National Development of DOST and having been identified as a lead educational institution in the BIMP-EAGA, has classified commodity centers for science and technology R&D: For MSU-Marawi, cutflowers and root crops; MSU-IIT, alternate building materials; MSU-Tawi-Tawi, seaweeds; MSU-General Santos, tuna; MSU-Naawan, abalone and crab culture; and MSU-Sulu, cassava and exotic fruits. However, with very limited research funds very little impact for the advancement of science and technology can be achieved.

While the paper has recommended the promotion of Mindanao as an ecotourism center, it is however very important that the conservation of biodiversity be considered. Biodiversity conservation should be backed up by strong scientific

guidelines and not just by pure advocacy. Efforts should be supported with scientific information otherwise, the fragile environment which is earmarked for development as an eco-tourism attraction will be imperiled.

After decades of thorough studies by Philippine and Malaysian scientists on the biology and ecology of marine turtles and the nature and responses of small island ecosystems, the Philippines and Malaysia signed recently a bilateral agreement for the joint management of the Turtle Islands Heritage Protected Area. This comprises three islands on the Malaysia side and six on the Philippines side. These islands are known as major breeding and nesting grounds for green turtles *(Chelonia mydas)* ad the hawksbill turtle *(Eretmochelys imbricata)*. This agreement treats the nine turtle islands as a single conservation unit to be covered by a comprehensive conservation and management plan because the turtles in the area constitute one population of marine turtles. A component of this plan would make these islands as a model eco-tourism center where the resources would be well managed and the fisheries enhanced. Before the Turtle Islands of the Philippines and Sabah were declared as a marine reserve or a heritage protected area with the assistance of the World Wildlife Fund, there was sufficient scientific basis for decision and the management plan that was adopted. The continuous monitoring of the resources and evaluation of the management plan was also provided for.

I would also like to bring to the attention of this scientific body an emerging problem. The BIMP-EAGA region is within the center of the world's marine biodiversity but the extensive reef systems within the BIMP-EAGA region are facing a serious threat from the use of destructive methods of fishing, particularly the use of dynamite and of sodium cyanide. There is a need to come up with a concerted policy to check these practices in order to preserve the integrity of the coral reef ecosystem in the area. Coral reefs are not only favorite ecotourism spots because of the diversity of fauna and flora that these reefs support but also because they serve as spawning and nursery grounds of fishes. Hence, if these reefs are degraded, the fisheries in the entire region will not be secure.

I wish to close my reaction with the quotation from a famous scientist, "science and technology should graduate from one merely supporting national economic development to one directing this development towards the establishment of a technologically self-reliant society" and, I might add, for a more dynamic Mindanao. Thank you and *wassalam*.

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I wish to focus my reaction on what I perceive is a dimension common to both the BIMP-EAGA concept and technology transfer and adoption – the sociocultural dimension.

I will start by introducing you to a little study I made on the perceptions of 60 farmer cooperators in Davao Oriental on the BIMP-EAGA. The subject cooperative is one of the most progressive cooperatives in the Region. I did this study to illustrate that very little is known about the BIMP-EAGA in rural communities, a development strategy born in early 1994.

The study revealed that only eight out of sixty respondents claimed they heard about it. Most of them heard about it through radio, print TV, and two from some line agencies. Only one claimed he heard about it from a teacher while two from NGOs. Four claimed it was "pro-poor".

All eight included in their choices all the right concepts about BIMP-EAGA but four of them thought it was also a peace-keeping treaty. One thought it was also to unite member countries under one government. All eight, however, thought they had a role to play in promoting the BIMP-EAGA strategy.

Undoubtedly, the majority of the absolutely poor live in rural areas. Even for that reason alone, it is proper for any development policy to give high priority to rural development. It should integrate the poor into the overall socio-political and economic system. If it does not, the concept is in danger of becoming merely an acronym, a catchword or a slogan like many other well-meaning development policies.

Apparently, it is too early to venture to pass judgment on the BIMP-EAGA. To date, meetings, fora, and the like have been conducted mostly at the upper echelons of government bureaucracies of the member countries.

As to how the BIMP-EAGA would specifically address the needs of the rural poor is little known at the moment although it is intended to benefit the total population. As conceived, it may succeed in raising the nation's GNP. The big-business and developed-country orientation however of BIMP-EAGA could marginalize the poor. In the drive for economic growth, a worsening of income distribution may follow. The same orientation seems to rely greatly on the trickle-down effect of development to bring about economic growth. Historically, this concept has not significantly succeeded in alleviating the lives of the poor in developing countries.

Additionally, we should be wary of the fact that, in this context, apparently the poor do not share in the product of economic growth. As such, we can assume that the poor do not contribute significantly to socio-economic development. They simply execute development activities.

On the subject of technology transfer and adoption, advances in modern researches and technology for agricultural production are not easily accessed by ordinary farmers. Commercialization of use of these researches involves, more often than not, the importation of inputs and expenses for machineries which ordinary farmers cannot afford.

This brings us to the subject of "appropriate technology". The then deputy permanent secretary of the Ministry of Education in Thailand, Saiyut. Champatong, defined it so well as the "...social dimension of innovation ... that the value

of technology is not only in its economic viability and technical soundness but in its adaptation to local social and cultural environment." This definition implies that the assessment of technology requires some sort of value judgment both by the developer and the user. Simply translated, the choice of a technology must be applicable to local conditions. Thus chosen, it becomes "appropriate technology".

Hubert Kotter once said that the continued marginalization of small farmers is in part due to a deficient cognitive ability and to lack of communication – which means that the farmers cannot adopt what they cannot understand. This therefore implies that a development policy should adopt a package of effective communication and a system of delivery – which seem inadequate in our present techno-transfer activities.

The reason why low-cost technology is much more difficult to publicize is because there are no clearly established or effective communication channels in order to reach target groups. People, particularly rural folks, generally do not know about low-cost technology. Characteristically among rural populations, the demand for its does not arise independently.

What, therefore, is the primary task of government in relation to S & T in the development of Mindanao? The task at hand is to make rural poor communities know that appropriate technology exists and can be developed to help them improve their lives.

Government therefore should create, nurture, and rehabilitate the internal capacity of our people to invent and innovate. No one can refute the fact that development rests in large part on the internal innovative capabilities of a society. For us, this would mean that we should not only be more selective in the choice of imported equipment, plants, and methods of production; we should also invent and diffuse new technologies as well as forms of organization which are better suited to our local conditions.