

## SCIENCE AND TECHNOLOGY NICHES FOR THE PHILIPPINES

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In the last six years, from 1986 to the present, the Philippines has had two, maybe three, master plans for science and technology. One was prepared by Dr. Antonio Arizabal, President Aquino's first Department of Science and Technology (DOST) Secretary.

But barely a few months after he submitted his Science and Technology master plan, he was replaced by Ceferino Folloso as Secretary for Science and Technology, who proceeded to draft and submit his master plan.

I do not know what the differences are between the Arizabal master plan and the Folloso master plan. But I think I can safely hazard the opinion that it does not make any difference what those differences are because we now have a new Secretary of Science and Technology in Dr. Ricardo Gloria who, we can safely predict, will soon present his master plan for science and technology to President Ramos, if he has not done so already.

The point I am driving at is that under our present political system, any master plan for anything is doomed to failure, irrelevance or total amnesia, even before it starts.

Our constitution decrees a change in leadership every six years – formerly four – and that means changing not only the president and vice-president but also the top echelons of the bureaucracy. This is done in the absence of a top-caliber civil service, as in Britain and its former colonies; such is capable of, and constitutionally mandated to, carry out long-range planning and the execution of those plans, even though the Prime Minister and his Cabinet are subject to change at almost any day.

In our political system, every new president and his Cabinet throw away the master plans, projects and priorities of the previous government, in favor of their own master plans, projects and priorities, which in turn are also thrown away by the next government.

Consequently, we are forever starting with step one and step two, unable to get to step three and step four. And this applies to science and technology as it does to other fields.

Let me cite an example from my own family's experience. My father was appointed by President Quirino in 1951 to the board of directors of NASSCO, the National Steel and Shipyards Corporation, the state corporation that was tasked to build the country's first steel mill and first shipyard.

To this day, 42 years and 7 presidents later, the steel mill and shipyards of NASSCO have remained unintegrated, long since overtaken by the more recently established but more determined steel mills and/or shipyards of South Korea, Taiwan, Singapore, Malaysia, Thailand and Indonesia.

Compare this with the experience of Indonesia, whose science and technology master plan, conceived by the Secretary of State for Research and Technology, Dr. Baharuddin J. Habibie, has been in continuous implementation for 17 years now. It is geared toward making Indonesia a fully industrialized country by the year 2026.

I was in Indonesia in 1989 as a guest of the Indonesian government. I was shown some of their science and technology infrastructure, most of which had been envisioned and built, and still managed, by Dr. Habibie, whom I had the pleasure of talking with for one hour.

In 1989, Indonesia was already fabricating helicopters and fixed wing aircraft, including a 35-passenger, two-engine passenger airliner. This airliner, co-designed and co-manufactured by Indonesians and Spaniards, was fabricated from raw aluminum slabs, not merely assembled from imported components.

The aircraft factory in Bandung also fabricates components for Boeing 727 and 767 airliners, as well as for the F-16 Flying Falcon, the top-of-the-line fighter-bomber of the US Air Force and Navy, in service with many other air forces around the world. The Indonesians also make components for Rolls Royce aircraft engines.

The Indonesians also showed me their shipyards in Surabaya, which produce oil tankers and container ships for their maritime industry, as well as warships for the Indonesian Navy. Also in Surabaya is a diesel engine plant that manufactures, not just assembles, diesel engines of up to 6000 hp and electric generator sets of up to 4500 kva.

I was also shown their telecom industry in Bandung, where telecommunications equipment are manufactured. Such equipment include earth stations for their four space satellites, as well as telephone switching equipment for up to 40,000 lines each.

Backstopping all this is a science and technology research center – PUSPIPTEK – in Serpong, a 1,000-hectare facility with complete facilities for 700 scientists and engineers. PUSPIPTEK has modern research facilities in chemistry, physics, metallurgy, nuclear science, propulsion, electronics, computers, etc. It even has state-of-the-art wind tunnel to support its aerospace industry.

The genius behind this science and technology quantum leap by Indonesia - Dr. Habibie -- graduated summa cum laude in aircraft design from the Technische Hochschule in Aachen, Germany. After graduation, he worked for the famous Messerschmitt aircraft company, where he rose to become vice-president for research, with 80 German engineers under him.

While working for Messerschmitt, Dr. Habibie borrowed money from the company and he used this loan to finance the advanced education abroad of a number of Indonesian scientists and engineers who became his cadre for building Indonesia's science and technology infrastructure.

By 1989, Dr. Habibie had sent 4,000 young Indonesians to study science and engineering in North America, Western Europe and Japan, financed up to 80 per cent by the World Bank.

Dr. Habibie told me how in the early 1970s he was sent to Manila by his company to help start an aircraft industry here, on request of President Marcos. He did what he could for a while, he said, but there was no master plan for local fabrication, only the assembly of imported components. Naturally, he did not give away his master plan, which he started to implement for his beloved Indonesia when President Suharto summoned him home in 1976.

The Philippines needs a genius like Dr. Habibie to envision and implement our industrialization according to a master plan.

But it is my contention that even if we had a Dr. Habibie and a master plan for science and technology, they would be wasted here because our political system does not allow any long-range planning and implementation, however brilliant, for longer than six years.

Our political systems condemns us to mediocrity forever, unless and until it is drastically changed.

If I were running the science and technology establishment in the Philippines, I would forget about ambitious master plans because they would be thrown away by my successor anyway. It would be futile to plan anything beyond six years in this country. Our political system militates against it.

I would instead concentrate on finding three or four niches under the following considerations and pour all resources into these three or four niches:

- a. There must be a real and desperate need for the object of the research;
- b. The object of the research must use indigenous resources that are available in great abundance;
- c. The object of the research must result – or at least have the potential of resulting – in a qualitative change in society in the shortest possible time; and
- d. Close collaboration with a technologically advanced country is essential to hasten the research process.

Under the above parameters, and given that only at most six years are available under our political system, I would concentrate on just the following:

1. **Low-cost, pre-fabricated mass housing.** I realize that Secretary Gloria recently inaugurated some low-cost housing units, 35 sq. m. in area, and costing only P80,000 per unit.

But this is not what I have in mind. The low-cost mass housing that I envision needs research in the matter of materials and design, the ideal being a design whereby components are mass-produced by specialist production units and then assembled *in situ* like giant Erector sets, each one in a matter of hours, not days or weeks.

This means that a production unit will fabricate only roof trusses, another only roof components, another only windows, or only doors, or only wall components, or only stairs, etc. All will be according to strict specifications so that they can be assembled into single detached houses, duplexes, quadruplexes, or row houses, as the case may be.

A massive program of low-cost, pre-fab mass housing, backed by constant research in materials and design technology, would change for the better the landscape of our towns and cities, and provide a better quality of life for the poorest of our poor. It can even turn out to be a lucrative export industry.

2. **Alternative sources of energy.** Blessed with abundance of sunshine the whole year round, this country should be at the forefront of research in solar energy, which, based as it is on a limitless resource, is the energy of the future. But research must be conducted now.

Except for a modest effort with the German government, there seems to be no serious effort at research on solar energy, whether thermal or photovoltaic. I propose a joint effort with the South Koreans or the Japanese on thermal solar energy, rather than on photovoltaic solar energy.

Research on thermal solar energy is within our means because it deals with techniques for more efficient focusing of the sun's rays on a black box to boil water into steam that will turn the turbines of a generator. Research on photovoltaic solar energy, on the other hand, involves potentially expensive search for materials more efficient than, say, selenium or gallium arsenide in converting photons of light into streams of electrons.

There is also room for research on wind energy, perhaps in collaboration with existing wind energy research efforts in California and Hawaii. I have seen the wind energy research facility near Livermore in Northern California. Dozens of wind generators dot the barren hills. But these are all horizontal-axis windmills that need much open space.

Perhaps Philippine research on wind energy can concentrate on wind generators with vertical axes, using fabric or metal foil sails instead of propeller blades. Assuming equal outputs, a battery of three vertical-axis wind generators, one on top of the other in a structure, can theoretically generate three times as much as one horizontal-axis generator occupying an area of equal size.

Finally, on the matter of alternative sources of energy, there should be serious efforts to support the pioneering work of Filipino inventor Rudy Lantano in developing a fuel mix that is 85% diesel fuel and 15% alcohol.

There is nothing revolutionary about this. During the Japanese occupation, my father, who was a mechanical engineer, used diesel fuel mixed with coconut oil for the engines and vehicles of his company.

Lantano's breakthrough is achieving an apparently stable mixture without using a chemical additive, catalyst or wetting agent. . . only a vigorous agitation of the mixture. Physical chemists can theorize that the induced turbidity caused the different hydrocarbon molecules to link together temporarily in a stable and evenly distributed mixture.

Whatever the scientific explanation for Lantano's breakthrough, it is made even more beneficial by the apparently more complete combustion that the mixture undergoes. Lantano's empirical data, based on the performance of cargo trucks in a Batangas sugar refinery and of buses on the EDSA route in Metro Manila, claim a virtual elimination of pollution in the form of black fumes so common among jeepneys and buses in Metro Manila.

Lantano's breakthrough can not only reduce our dependence on imported oil and decrease pollution in our cities. It can also generate employment in the countryside by creating a market in the cities for anhydrous alcohol produced from sugar cane. It can save our moribund sugar industry and create hundreds of thousands of jobs in the rural areas. And it can also become a lucrative export industry.

3. **Electric rail transport.** I propose that the Philippines strive to attain world class expertise in electric rail transport, in the same way that Indonesia attained world class expertise in below-50-passenger, propeller-driven air transport.

Indonesia did it through a four-step process devised by Dr. Habibie:

- a. Enter into an agreement with a foreign partner to assemble imported components of the partner's product for sale and use in the domestic market and part of the global market;
- b. Gradually fabricate locally made and more of the imported components;
- c. Enter into an agreement with the foreign partner to co-design and co-manufacture a completely new product, to be marketed in the shared global market; and
- d. Using the experience gained in steps a, b and c, design and manufacture a completely new product without any foreign help, for sale in the global market.

Thus has Indonesia scored a breakthrough in a technology formerly reserved for much more advanced countries. If Indonesia can do it in the aerospace industry, there is no reason, aside from our limiting political system, why the Philippines cannot do it in another industry, like electric rail transport.

Why electric rail transport? From a combination of several factors, Metro Manila is becoming asphyxiated by both pollution and an antiquated public transport system. Our jeepneys and buses are totally inadequate for our needs and are injurious to our health.

The only solution is to switch to electric rail transport in a few years, after we have solved the power crisis. Furthermore, dwindling oil reserves as well as growing concerns over pollution and global warming make this a universal solution to a growing universal problem.

In other words, in the next few years, there will be a growing market worldwide for electric rail transport systems, and the Philippines could choose this early to establish world class expertise in this technology. That is, if we can get our minds away from politics for a while.

In closing, I repeat my proposal that we forget about grandiose master plans for science and technology, which our political system will not allow us to implement anyway. Instead I suggest that we channel our energies and resources into only three niches and concentrate on these niches. These are: a) low cost, pre-fab mass housing; b) alternative sources of energy, such as solar, wind and alco-diesel; c) and electric rail transport systems.

Thank you for your attention, and good day.

**SYMPOSIUM VIII**

**Symposium Title :** Science and Technology Niches in the Philippines  
**Moderator :** Academician Ernesto O. Domingo  
**Rapporteur :** Academician Clara Y. Lim-Sylianco  
**Speaker :** Mr. Antonio C. Abaya

**SUMMARY**

Master Plans in Science cannot work out in the Philippines because of our political system. The best approach will be to harness the idea of a working genius in a particular field like what they do in Indonesia.

Develop deeply some niches such as:

1. Alternative energy sources like solar and wind energy and a combination of alcohol and diesel fuel (Lantano's);
2. Low cost housing that can be set up in hours; and
3. Electric rail transit development.

**RECOMMENDATION**

Adopt the proposal of Mr. Antonio Abaya.

