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**National Academy of Science and
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Department of Science and Technology**

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**National Academy of Science and
Technology Philippines**
Department of Science and Technology

26th ANNUAL SCIENTIFIC MEETING

On Being and Becoming: Where We Are And Where We Want To Be

14-15 July 2004, The Manila Hotel

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THE SCIENTIST AS HUMANIST AND STATESMAN

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Chief Justice
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Manila

Abstract

Science has become a part of everyday experience. Man, in his complete reliance on tools sometimes loses sight of what he is building; thus, such tools have stunted or confused the search for meaning and purpose. The tools of law in its traditions and stability must be coupled with scientific innovations. While scientists strive to unify the sciences, so also must the sciences be unified with the law. However, scientists should never tire in urging the law to catch up with them. What law and policy ask of scientists is no small feat. Not only do scientists have to convince government leaders, but their advocacy must stretch to every sector of society. Our nation's dedication to science and technology and the purpose behind it is an explicit State policy. Section 17, Article II (Declaration of Principles and State Policies) of the 1987 Constitution provides that the State shall give priority to education, science and technology, arts, culture and sports to foster patriotism and nationalism, accelerate social progress, and promote total human liberation and development." Scientists are urged to propagate the tradition of science that teaches individuals and, ultimately, nations, the power to dream, to create, to act, to reason, and if it fails, to try again. This is not only within the power of science to do, but the power of science in a democracy.

Keywords: science, law, democracy, humanist

Science, a part of everyday experience

Perhaps from the standpoint of a scientific layman – with “scientific” in quotation marks – I can only declare with authority the speed with which scientific theory has become part of our everyday experience. Much of this transformation has occurred in my lifetime. We have learned to utilize atomic power for both destructive and constructive purposes, and the Internet has evolved from a military exercise to the plaything of toddlers. The world watched as man took his first steps on the moon and we recorded it in its original black and white splendor so we continue to share this moment with our children. In international fora which I attended, Justices and Judges were exposed to discussions on, among other things, the role of the courts vis-à-vis human and medical genetics, agricultural biotechnology, biotechnology-related cases involving human dignity, human rights and human nature, global biodiversity, environmental damage and compensation, sustainable development, and bio-terrorism.

Indeed, the marvels of science and technology astound and confound us. The farther we go from the earth, from the moon to Mars or to Saturn’s rings, we increase the capacity of men and women to dream and create, and inspire us to push limits. However, we find that, in many cases, the humanitarian purposes of the inventions are yet to be clearly defined. I would therefore commiserate with Einstein in his fears. In the aftermath of the destruction of Hiroshima and Nagasaki he said that “[o]ur world faces a crisis as yet unperceived by those possessing power to make great decisions for good or evil. The unleashed power of the atom has changed everything save our modes of thinking...” Einstein saw the difficulty of mankind in catching up with our inventions. The world can only watch as knowledge in science has grown to proportions beyond what our human experience can fathom. Our problem lies in that human experience; the amalgamation of all that we know in faith, family, and country is the ultimate measure of our ability to make value judgments: what is right or wrong, what is just or unjust, what is good or bad. To accept this acceleration without evolving our way of thinking may validate Einstein’s prediction that we now “drift toward unparalleled catastrophe.”

Einstein had dire predictions. Unfortunately, they are not so farfetched if we take into account how nuclear weapons are being used as a bargaining point for sovereign demands; or that chemical or biological warfare and weapons of mass destruction threaten the existence of peoples and races or to subjugate nations or perpetuate political ideology; or that the cure for diseases can be used as leverage during trade negotiations.

But I am not drawn towards these ultimate predictions. The fears exist, yes, and I can only agree that mankind is struggling to catch up with the meaning of its

inventions. Still, I cannot but be hopeful. The reason is because I believe in a democracy.

Science and democracy

The tradition of a democracy has much in common with that of science. What else is science but a series of laborious trials and errors with its rare but glorious moments of enlightenment? Where would science be if old ideologies, some of which were established for centuries, could not be questioned or overturned? In other words, what is not science also, but creation and destruction, of birth and rebirth? Such also is the case in a democracy. A democracy is not about perfect laws, absolute freedom, or limitless rights. Where would we be if not allowed to make mistakes? Democracy has had its share of successes and errors; it is made by people who know, or should know, that while laws are meant to be timeless, they are not written to predict all possible outcomes. Among the virtues of a democracy is that laws are not always meant to forecast societal change, but leaves it to the wits and freedom of women and men to adopt to change.

Needless to stress, we find the chasm between science and values to be increasing, and still we stand in the middle, with many at a loss in the absence of a compass. No matter how much scientific thought and reasoning have empowered mankind thus far, many have forgotten that these are essentially tools to understand and serve humanity and our natural environment. Our complete reliance on tools while losing sight of what we are building has stunted or confused the search for meaning and purpose. This can only be discovered by using the tools of science and law together.

Science and law

The study and goals of science and law are similar in that both are but tools to seek truth through the use of reason. But there is an important distinction. On the one hand, science is driven towards innovation and constantly fuels change. The imagination and industry of scientists keep us in a constant state of surprise at how we can always be a little bit better than we conceived. On the other hand, the law is ultimately normative and defined by traditions that are jealously guarded. The law is meant to provide foundations, which is not wont to change except in light of strong evidence of social, cultural or even professional acceptance. So it is that the law, a vague reflection of human experience, often takes longer to manifest what may be obvious to all of you as scientists.

I am sure that we would all wish that decision makers be the technocrats or specialists who are as well versed in the policies they draft, interpret, or implement. I am sure you have experienced how easily policy can be diluted from the time it is written until the time it is executed. But not everyone can be a technocrat or specialist, and perhaps better that it cannot yet be so. For the people are not yet technocrats or specialists, and the aim of law and government is not only economy or financial development. As found in our Constitution, the sovereign Filipino people implore the aid of Almighty God in order to build a just and humane society. It talks of our ideals and aspirations and the common good, and of securing for ourselves and our posterity the blessings of independence and democracy under the rule of law and a regime of truth, justice freedom, love, equality and peace. A government of the people must be holistic and represent and balance the many and diverse priorities of the people.

The tools of law in its traditions and stability must be coupled with your innovations. Where you strive to unify the sciences, so also must the sciences be unified with the law. I only ask that you never tire in urging the law to catch up with you.

What law and policy ask from you is no small feat. Not only do you have to convince government leaders, but your advocacy must stretch to every sector of society. In the criminal justice system, for example, it is not only a matter of convincing the judge of the relevance and reliability of a piece of scientific evidence or theory, but also all the other pillars in the criminal justice system. There are also the investigators and the prosecutors, as well as the community whom you serve. It is not only the legislators and policy makers, but also the constituents they represent who must be convinced of the greater good you are trying to achieve. The beauty of a democracy is that it knows that women and men are not perfect, and therefore allows for change. Educating the people, promoting their ability to understand these changes, encouraging the free and bold exchange of ideas, remain the key.

As with all scientific endeavors, your efforts have had the greatest rewards. In the United States, where class distinction between black slaves and citizens had been justified in the 19th century, the case of *Brown v. Board of Education* (347 U.S. 483) in 1954 marked the desegregation of whites and blacks in public elementary and high schools. The decision penned by Chief Justice Warren tested the limits of the "separate but equal doctrine" where segregation was thought to be justified as long as the segregated schools offered, "substantially equal facilities." Mr. Warren cited several authorities on the psychological effects of segregation and how such tangible factors as the number of teachers or books cannot alone measure the value of the facilities that were being offered.

Only recently, the Philippine Supreme Court explicitly affirmed the use of DNA testing to identify the perpetrator of the rape. This was in *People v. Yatar* (G.R. No. 150224) decided on 9 May 2004, where the Supreme Court affirmed the conviction of

a man who had raped and murdered a seventeen-year-old girl. Since the Court is constrained to act only when a case is filed and ripe for adjudication, the use of DNA had taken long in coming. Where in earlier cases (*People vs. Vallejo*, G.R. No. 144656, 9 May 2002; *Tijing vs. Court of Appeals*, G.R. No. 125901, 8 March 2001) the Court could only refer to DNA's use or reliability, *People v. Yatar* laid down the necessary steps in ensuring the purity of DNA sampling to uphold its integrity as evidence. This could not have been done without the efforts of the scientific community, through their studies and cooperation by being expert witnesses and, more importantly, the willingness to share knowledge and the ability to communicate its relevance to the courts and to the other pillars of justice.

This is a lot to ask for in advocacy of science. But as in the case of *People v. Yatar* the punishment of such a crime, or in reverse, the exculpation of a potential innocent serves the utmost in ensuring the determination of the truth in the courts of law. This is but a small example of your power. What more when our citizenry is likewise educated of their own capacity and trained in the art and science of logic and reasoning, who would be left to ignore the sober but compelling voice of science and passion? It is no wonder that Maximo T. Kalaw described scientists as "the new public thinkers, people who not only know things but who shape the thoughts of their generation." The scientists must be the statesmen.

A progressive Philippines anchored on science

This brings me to the theme of your 26th Annual Scientific Meeting: "On Being and Becoming, Where We Are, Where We Want to Be." No doubt it expresses noble and grand objectives. It demands a solemn pause and deep reflection for it speaks of life and its purpose; of change and growth; of responsibility and service. Yet we only need to look at the vision of the National Academy of Science and Technology to get our bearings: "A progressive Philippines anchored on science." This vision of the Academy is reflected in our Constitution.

Our nation's dedication to science and technology and the purpose behind it is an explicit State policy. Section 17, Article II (Declaration of Principles and State Policies) of the 1987 Constitution provides that the State shall give priority to education, science and technology, arts, culture and sports to foster patriotism and nationalism, accelerate social progress, and promote total human liberation and development." To further elaborate on this policy, the Constitution dedicates one Article (Article XIV) out of eighteen to Education, Science and Technology, Arts, Culture and Sports. This Article XIV devotes a sub-article, with four sections, on Science and Technology, whose opening section (Sec. 10) asserts that "Science and technology are essential to national development and progress."

The subsection on Science and Technology, along with the subsections on Arts and Culture, as well as the Article on Social Justice and Human Rights (Article XIII), are unique additions to our own Constitution.

Concretely then, science and technology are indispensable to the acceleration of social progress and the promotion of total human liberation and development. Put in another way, science and technology are indispensable in serving and promoting life itself by securing for all a balanced and healthful ecology and ensuring humanity against the forces of decay, such as hunger, disease and death. Science and technology are indispensable instruments in the building of a just and humane society. As envisioned then by our Constitution, scientists and technologists must be humanists, statesmen, patriots. As humanists they listen to Einstein's words: "Concern for man himself and his fate must always form the chief interest of all endeavors. Never forget this in the midst of your diagrams and equations." And these words of the Gospel must constantly inspire you to serve others: Put out into the deep (Luke 5); take care that the light in you does not become darkness (Luke 11); Be not afraid (Matthew 28; Luke 243); and the harvest is abundant but the laborers are few (Luke 10). With the Constitutional mandate and these thoughts, the heart and the response to the theme of your 26th Annual Scientific Meeting are not difficult to find.

As I stand before the legally mandated scientific policy advisors of the country, where at least fifty lifetime members possessing doctorates in various fields of science and technology congregate as "the principal reservoir of scientific and technological expertise in the nation," (Sec. 1, P.D. No. 1003, "Creating the National Academy of Science and Technology," 22 September 1976, amended in 16 December 1976), I see a special repository of humanists, sacrificing patriots and able statesmen fully recognized to assist the nation in carrying out the purposes of our Constitution. Truly then, the National Academy of Science and Technology Philippines has the mandate of the sovereign will of the people.

Yours is a tradition of professionalism, of precision, of sobriety, of creativity, of imagination, all founded on the proven integrity of your experiments and studies – all of your life's work. If integrity be your legacy and what makes you the experts that you are, then by no means should your voices be stifled.

The power of science in a democracy

Let science then be the tradition through which we can become fearless when we seek to reinvent ourselves. Let progress not be our ability to hold fast to what we once were. Propagate the tradition of science that teaches individuals and, ultimately, nations, the power to dream, to create, to act, to reason, and if it fails, to try again. This is not only within the power of science to do, but the power of science in a democracy.

Let your knowledge be your tools, but concern for humanity in general and the Filipinos in particular always the aim. Our country is in need of no less.

May you come out with concrete proposals to strengthen the Constitutional role of science and technology in the acceleration of social progress, promotion of total human liberation and development, and in the building of a just and humane society.

CHURCH AND SOCIETY
“On Being and Becoming:
Where We Are and Where We Want To Be”

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Abstract

The paper deals primarily with the role of the Catholic Church and of Christian tradition in national culture, the Church and Christian tradition as interpreter of national experience and bearer of national culture. It cites as an explicit example of this role in EDSA I and in the Revolution of 1896. It further deals with this role of the Church in community and national culture. The author takes note that as the Philippines moves towards modernization, science and technology are essential, democratic ideals are essential, whether we like it or not, global influences through business, technology, our overseas workers dominate our consciousness more and more. The challenge is how we are to remain who we are (identity), how we are to remain as a community, how we are to find meaning in the world that seems to threaten our fundamental self and values. What is emerging in the Church in the Philippines are powerful movements that bring people together towards community and identity, in particular, various charismatic-based movements. Some remain inward turned and risk becoming closed-in fundamentalist groups others respond to the call of the Gospels to be their brother's and revolution needed for modernization.

The paper highlights progress made and challenges faced by movements seeking to build meaning-structures founded on the Christian Gospels and at the same time responsive to need to reach out to the poor and build community among all Filipinos. In many ways this is a search for Christian meaning-structures that will bridge the cultural divide between the modernized Christianity of many middle-class Filipinos and the traditional Christianity of the masses. In building that bridge, the Church can then play a critical role in both moving the Philippines forward towards modernization and at the same time keep our sense of identity, community, and meaning whole.

Keywords: Christianity, traditional, modern, Philippines

Introduction

Reflecting on the theme of our Annual Scientific Meeting, we see today that we remain sadly the "sick man" of Southeast Asia; we are a country of very fragmented and fractious cultures and community. We continue to seek to become a progressive, modernized country. But that cannot be achieved without a national community and culture that can sufficiently overcome fractiousness and division so it can focus on the tasks towards our common goal. Such a level of national community and culture needs shared meaning-structures, shared "myths" and stories, shared vision.

There are many ways in which we can speak of "Church and Society." But given these dominant challenges of national community and culture, I would like to speak today mainly of the role of the Church and of Christian tradition in national culture, the Church and Christian tradition as interpreter of national experience and bearer of national culture.

Church and Christian tradition as interpreter of national experience and bearer of national culture

The recent past: EDSA 1

This role was probably most explicit in EDSA 1. It was a period where I was deeply involved as Provincial of the Jesuits in the Philippines. In an invited paper I gave in Tokyo in 1988 on "Science, Technology and Spiritual Values: Searching for a Filipino Path to Modernization," I wrote:

One of the enduring memories for many of us was the experience of the revolution of 1986 as a process of political change, which was also a profoundly religious experience. For myself, I used to turn to Psalm 44 ("We have heard with our ears, O God, our fathers have told us, what deeds thou didst perform in their days ... Yet thou hast cast us off and abused us and hast not gone out with our armies.") to express my feeling of God being so distant from our struggles. In those February days, there was a feeling of great wonder that God had come to march with us once more. Many of us came to the realization of the power for change in the popular symbols of faith: it was in the rosary that people found strength as they faced the tanks; they struggled to sing the "Our Father" as the soldiers came with teargas attacks. They waved rosaries and bibles to the soldiers in their appeal for unity and peace. It was in rosaries and hymns and the presence of statues of Our Lady that we found strength in the lonely and fearful vigils between midnight and dawn [1].

Soon after the EDSA revolution, the Loyola School of Theology at the Ateneo de Manila held a symposium to reflect on the experience. In the talk given by Fr. Arevalo, he recounted the experience of the seminarians and Ateneo students at Libis as they tried to be a buffer between Camp Aguinaldo and government troops coming in. They actually held for quite a while, but finally had to yield to teargas and soldiers coming with fixed bayonets:

Forgive me if I speak of our common experience at Libis, - there, where Boni Serrano Ave. (Santolan further up!) and Katipunan cross each other. One of the things we will always remember about Libis is what we experienced of communion. "We are one people when we pray." We were at one when we prayed together. We were at one too when we stood "kapit-bisig" and were perhaps willing to die together, with our arms locked together. Not a bad way, in a brotherhood, to die. That was, I guess, an experience of communion. I wonder when we will share another such experience.

Sometime that night an image of Our Lady of La Naval was brought to our corner, in procession. Not a small image, but the big one they use in the annual procession from Sta. Domingo. And people flocked around, to pray the Rosary.... At this hour, here at Libis, not long after we had withstood the first wave of troops, Our Lady of La Naval comes. What that image meant at that moment, as if Our Lady were saying, "As I saved your people from the Dutch, centuries ago, so I will save them now." And the beauty and courage and strength we drew from her presence, and the words of the Hail Mary spoken in that quiet night [2].

A Century ago: Revolution of 1896

Rey Ileto in "Pasyon and Revolution" writes of how peasant leaders in the Katipunan saw in the Christ-figure a model for themselves. On the surface His quiet, meek image may seem to lead to docility, but its effects were, in fact, subversive:

Jesus Christ in the pasyon text appears as a rather harmless leader of humble origins but he manages to attract a huge following mainly from the "poor and ignorant" class. His twelve lieutenants are said to be neither principales nor ilustrados, nor the leader's relatives. They are simply

<i>ducha at humac na tauo</i>	<i>poor and lowly people</i>
<i>uulang halaga sa mundo</i>	<i>without worth on earth</i>
<i>manga mangmang na tauo</i>	<i>ignorant people</i>
<i>uulang dunong cahit uno.</i>	<i>without any education.</i>
<i>(49: 7)</i>	

Yet, the pasyon account continues, these lowly men were charged by Christ with a mission and given special powers to carry it out:

<i>Ito ang siyang hinirang</i>	<i>These were the ones selected</i>
<i>ni Jesus na Poong mahal</i>	<i>by Jesus the beloved master</i>
<i>magpapatanyag nang aral</i>	<i>to popularize his teachings</i>
<i>gagaua nang cababalaghan</i>	<i>to perform astonishing feats</i>
<i>dito sa Sangsinucuban.</i>	<i>here in the universe.</i>
<i>(49: 8)</i>	

The pasyon abounds with passages like the above, suggesting the potential power of the pobres y ignorantes, the "poor and ignorant," to use the common ilustrado term for the masses [3].

We can still hear echoes of this ethos in the views of the poor in the presidential campaigns of President Joseph Estrada and Fernando Poe Jr. In fact, this ethos has continued in many other political movements throughout our history.

The continuity in form between the Cofradia of 1841, the Katipunan revolt of 1896, the Santa Iglesia and other movements we have examined can be traced to the persistence of the pasyon in shaping the perceptions of particularly the poor and uneducated segments of the populace. Through the text and associated rituals, people were made aware of a pattern of universal history. They also became aware of ideal forms of behavior and social relationships, and a way to attain these through suffering, death, and rebirth. And so in times of crisis – economic, political, real or imagined – there was available a set of ideas and images with which even the rural masses could make sense out of their condition. Popular movements and revolts were far from being blind reactions to oppression. They became popular precisely because leaders were able to tap existing notions of change; the pasyon was freed from its officially sanctioned moorings in Holy Week and allowed to give form and meaning to the people's struggles for liberation [3].

I was very struck in recent years how powerful these images continue to be in our day. The great earthquake that damaged Cabanatuan and Baguio in 1990 also hit several La Union towns and damaged the churches. But the damage stopped before my hometown of Bacnotan. When my townmates later spoke of the event, they told the story of a barrio, where the day before an old man had come when it was already evening and asked to stay overnight. A family took him in, but when they got up the next morning, he was already gone. And then the earthquake struck, but Bacnotan was spared. They said, "That was St. Joseph and we were spared, because we took him

in."One could also cite the very interesting article that appeared in the Economist of December 2000, entitled "The Anthropology of Happiness" about Filipina domestic workers in Hong Kong and how their faith gives meaning, direction, and cohesion in their heavily burdened lives.

The key point in these examples is that the Christian Scriptures and the Christian tradition remain the main matrix of interpretation of reality for many Filipinos, especially in times of crisis and challenge in our Filipino life.

Understanding this role of the Church in our community and national culture

The Church has many roles in national, community and personal life: moral authority, interpreter of religious law and practice, and promoter of social justice. The events and stories I have cited above focus on its role as providing meaning and meaning-structure through rituals, stories, and songs.

A. In a very insightful paper entitled "The Catholic Imagination," the priest-sociologist, Fr. Andrew Greeley, explains why this level of faith is so central for us. He writes:

Religion begins in 1) experiences that renew hope. These experiences are in turn encoded in 2) images or symbols that become templates for action, and are shared with others through 3) stories that are told in 4) communities and celebrated in 5) rituals. This model is circular, not a straight line, and hence the stories, communities and rituals in their turn influence experiences of renewed hope.

Religion takes its origins and its raw power from experiences, images, stories, community and ritual, and that most religious socialization (transmission) takes place through narrative before it takes place in conceptual, analytic form. Religion must be intellectual but it is experiential before it is intellectual.

The Catholic tradition is passed on especially in the stories of Christmas and the Easter Passover. Maybe half our heritage is transmitted to children around the crib at Christmastime...[4]

B. Another way of looking at this central role of the Church may be taken from Karen Armstrong's "The Battle for God." She writes:

*[Our ancestors] evolved two ways of thinking, speaking, and acquiring knowledge, which scholars have called **mythos** and **logos**. Both were essential; they were regarded as complementary ways of arriving at truth, and each had its special area of competence. Myth was regarded as primary; it was concerned*

*with what was thought to be timeless and constant in our existence. Myth looked back to the origins of life, to the foundations of culture, and to the deepest levels of the human mind. Myth was not concerned with practical matters, but with meaning. Unless we find some significance in our lives, we mortal men and women fall very easily into despair. The **mythos** of a society provided people with a context that made sense of their day-to-day lives; it directed their attention to the eternal and the universal.*

***Logos** was the rational, pragmatic, and scientific thought that enabled men and women to function well in the world. We may have lost the sense of **mythos** in the West today, but we are very familiar with **logos**, which is the basis of our society. Unlike myth, **logos** must relate exactly to facts and correspond to external realities if it is to be effective. ... **Logos** is practical. Unlike myth, which looks back to the beginnings and to the foundations, **logos** forges ahead and tries to find something new: to elaborate on old insights, achieve a greater control over our environment, discover something fresh, and invent something novel.*

*In the pre-modern world, both **mythos** and **logos** were regarded as indispensable. Each would be impoverished without the other. Yet the two were essentially distinct, and it was held to be dangerous to confuse mythical and rational discourse. They had separate jobs to do [5].*

Christian faith and culture (Mythos): Becoming self-enclosed or opening to the future

The risk of becoming self-enclosed and fundamentalist

As we reflect on the interaction between Church and society, my major focus is on whether and how the meaning-structures, the interpretation of reality within the Christian tradition provide a helpful, even a coherent matrix for understanding ourselves and our national life. There is a risk that this meaning-structure can remain closed—in a timeless ‘mythos’ and thus closed-in from modernization or it can become a meaning-structure that can move us together towards a shared future.

This is completely understandable if we recall that our traditional faith structures were developed in our rural past. This rural past was based on an agricultural economy that had severe limits to growth. Karen Armstrong writes: “The roots [of modernity] lie in the sixteenth and seventeenth centuries of the modern era, when people of Western Europe began to evolve a different type of society one based not on an agricultural surplus but on a technology that enabled them to reproduce their resources indefinitely [5].” Rural society thus tends to live in a cyclical, limited world, limited by agricultural production. To move into the modern world, we need a culture that looks

at continuing innovation as the way to build economy. But this new culture needs a new way of believing, a new way of faith – which nonetheless must connect with the traditional faith of most Filipinos.

Thus our faith can lead to meaning-structures that remain closed, seeing reality in a timeless mode or in an ever-repeating cyclic mode

It can see the shaping of the future as outside our powers — simply waiting for the intervention of the Divine – leading to helplessness/ fatalism. This is quite prevalent in our culture, with our focus on *suwerte*, our weak confidence in our capability to shape our future

It can totally separate the realms of the Divine and of the human – a certain split-level Christianity as described by Fr. Bulatao

It can fall into a form of millenarism as in *Lupang Malaya* and other movements.

Rey Ileto opens his book “Pasyon and Revolution” with the *Lupang Malaya* event, reminding us that these millenarist movements continue into our time:

*One Sunday morning in May 1967, residents of Manila awoke to find a strange uprising in their midst. A little past midnight, street fighting had erupted along a section of Taft Avenue between the constabulary and hundreds of followers of a religiopolitical society calling itself **Lupang Malaya**, the Freedom Party. Armed only with sacred bolos, **anting-anting** (amulets) and bullet-defying uniforms, the **kapatid** (brothers) enthusiastically met the challenge of automatic weapons fire from government troopers, yielding only when scores of their comrades lay dead on the street [3].*

The promise of being a vehicle of meaning guiding us in the uncertain process of change.

In articles I wrote seeking to interpret our experience after EDSA 1, I used images from Exodus and Deuteronomy:

The image which expressed our longing for liberation was Exodus. God hearing the cry of his people and delivering them from the hands of Pharaoh. In February we achieved our liberation, experienced our Exodus. We felt that God's hands had not been shortened in our time. And then we saw the jockeying for political positions, the bickering in the Cabinet, the quarrels between business and labor and said: "Is this what we had revolution for? Have we achieved anything?" But read on from the crossing of the Red Sea. The Hebrews did not come so easily or so soon to the Promised Land. Listen to the people: "Would that we had died at the Lord's hand in the land of Egypt, as we sat by our fleshspots and ate our fill of bread!" Listen to Moses: "What shall I do with

this people? A little more and they will stone me!" Listen to God, "Go down at once to your people ... for they have become depraved. ... Let me alone, then, that my wrath may blaze up against them to consume them." The scenes we are experiencing after our "Exodus" are not too far different from the scenes of the first Exodus. They even had their loyalists and threats of a coup – when they went back to the Golden Calf of Egypt and tried to set up Aaron in place of Moses, because Moses was taking too much time with God away from the camp. The Israelites had to struggle with themselves and their weaknesses, with their leaders, with their God [6].

Several years later in 1989, I interpreted our EDSA I experience in the imagery of the Transfiguration image:

I have searched for the correct images and symbols to express how I regard that experience and those feelings. Reflecting on the Gospel of the Transfiguration on the second Sunday of Lent this year, I thought that they could well be expressed as a Transfiguration experience. In those February days we saw ourselves transfigured. We even gave up beer and the 'Manila Bulletin' after Cory's call on Feb. 16. I remember the courage and the euphoria before the tanks on Ortigas, ordinary people going up to those heckling the soldiers and asking them to please be quiet. As the tanks turned back towards Fort Bonifacio at sunset I remember a hand coming out of one of the turrets in a Luban sign.

It was a heady experience. But as with the first Transfiguration experience when the apostles came down and were presented with an epileptic boy, we left EDSA and suddenly saw no longer our heroic figures but only our very ordinary selves. We saw the various epilepsies afflicting our nation: graft and corruption, greed and selfishness, poverty and oppression. And we found that we could not exorcise them [7].

Can we scientists help in bridging our fragmented cultures? Since we are gathered together as scientists, I thought we might reflect on our particular role in this process of meaning, interpretation and the process of change and modernization. The first thing we have to note is that most of us Filipino scientists are comfortable living in both the scientific world and our world of faith. The traumatic break between faith and reason which is the Enlightenment in the West is something we know about, but it has not created a personal or intellectual trauma for most of us [8]. I believe this is true in general for Asian scientists. Some may be believers, some may not, but there is not the emotional antagonism that one sees in the West due to the legacy of the bitter battles between Church and science/ scientists in the history of the West.

Our challenge in the Philippines, I believe, is different. It is more a break between cultures (including faith cultures), than it is a break between faith and reason. The most obvious illustration is the break of cultures that we see between what we might regard as modernized Christianity and the traditional faith cultures of *Iglesia ni Cristo*, *El Shaddai*, *Jesus is Lord*.

In a very thought-provoking book entitled "The Medieval Foundations of the Western Intellectual Tradition, 400-1400," Marcia Colish writes of the three great civilizations of the middle ages, which were heirs of the Greco-Roman tradition: Byzantium, Islam, and Western Europe. She says, suppose a traveler were to look at these civilizations and cultures at the beginning of the second millennium, the year 1000. If one were to predict then, she says, which would be the dominant culture in the next millennium, one would not have chosen Western Europe. One would have chosen either Byzantium or Islam. But a couple of hundred years later, Western Europe emerged and began its ascent to be the dominant culture of the millennium. Her basic thesis is that the culture that underlay the energies that created modern Europe came from a **living fusion** between high and low cultures in the middle ages. Unlike in Byzantium and in Islam, where high and low cultures remained separate, and high culture eventually became frozen in an idealized state, European Christianity appropriated its Christian heritage and fused it with the traditional life of ordinary people. This interplay between high and low culture, including the rise of vernacular languages and vernacular literature, not separate from, but together with the ancient traditions, created the cultural energies towards modernization [9].

If we look at our situation – of an elite culture that is in English, reads mostly English books, watches American movies and television shows, but comprises about 1 to 5 percent of the population and a mass culture that is Tagalog or vernacular, rarely reads or reads Tagalog, watches Tagalog movies and television shows, and comprises over 90 percent of the population, one way of formulating the challenge to us scientists is whether the thesis of Marcia Colish is valid for us and whether a major task before us is to ask how we might contribute to bridging cultures and fusing high and mass culture together towards the creative energies needed for us to achieve modernization.

We may believe that rationality and "progressiveness" are in our "high" cultures, but I invite you to reflect on the energy and drive that is in the mass culture. This should be obvious as we look at the numbers that faithfully attend *El Shaddai* community and liturgy events, *Jesus is Lord* events, *Iglesia ni Cristo* events. Clearly these faith communities provide energizing meaning for their members – more powerful and motivating than is provided in the mainstream communities.

We might reflect that the rituals, the imagination, the meaning-structures in these traditional faith communities are experienced as giving hope and coherence, giving life to the many who make sacrifices and give time to be there.

What is our role as scientists, intellectuals in this process? – I think our first challenge is to acknowledge this break in cultures, in some way it is even in our own

souls. I think that many of us scientists gathered here grew up in traditional faith communities – our experience is not alien to those in the faith communities I mentioned above. But we have not reflected on this experience enough. Can we reflect on it, find what is deep and energizing in it, allow ourselves to connect to the mass groups and help them to find a modernizing way into the future. The next and deeper challenge is to ask how we may achieve something of what the medieval West did, fuse these cultures together and thus generate the modernizing energy needed for our nation. In some ways it is our way of sharing the mystery of the Incarnation. We need to enter into the cultural, meaning world of traditional faith communities, dialogue from within and see how the cultures can enrich each other.

Left to themselves, these traditional faith cultures are likely to become fundamentalist, at times even millenarist. Because, as Karen Armstrong writes, it is their response to their sense of helplessness, of facing forces too powerful to overcome by rational action. She illustrates this in the Sephardic Jews in exile from Spain, in the Shiites of Iran. We can see the same phenomenon in *Lupang Malaya*, Santa Iglesia and other groups in Rey Ileto's "Pasyon and Revolution."

What in turn allows such a faith-meaning-structure to become an opening into the future — following Marcia Colish' analysis of the emergence of Europe from what we call the Dark Ages, we see that it is the appropriation of structures of hope from the faith meaning structure in popular culture. The Gospels did not become simply a refuge into the past, but they fused into the popular stories of romance, for example in the legends of King Arthur and the Knights of the Round table, which became not only stories of romance but quests for the Holy Grail.

There have been many different ways in which Christian tradition has sought to connect the new modernizing cultures with faith traditions. Karen Armstrong gives the example of the development of the Social Gospel in early 20th century America:

Protestants developed what they called the "Social Gospel" to sacralize the Godless cities and factories. It was an attempt to return to what they saw as the basic teachings of the Hebrew prophets and of Christ himself, who had taught his followers to visit prisoners, clothe the naked, and feed the hungry. Social Gospelers set up what they called "institutional churches" to provide services and recreational facilities for the poor and for new immigrants [5].

Today for many young people, they resonate with the call of Fr. Pedro Arrupe to be Men and Women for Others. This articulation of the Call of the Gospel both connects with our traditional faith and is a source of meaning and drive to build a better future for our people.

Today our prime educational objective must be to form men and women for others; men and women who will live not for themselves, who cannot even

conceive of a love of God which does not include a love for the least of their neighbors, and who are completely convinced that a love of God which does not result in justice for all is a farce.

Just as we are never sure that we love God unless we love our fellow human beings, so we are never sure that we have love at all unless our love issues in works of justice.

This means, first, that we must have a basic attitude of respect for all men and women, which forbids us ever to use them as instruments for our own gain.

Second, it means a firm resolve never to profit from, or allow ourselves to be suborned by, positions of power derived from privilege.

Third, it means an attitude not simply of refusal to participate in injustice but of counterattack against injustice, a decision to work with others toward the dismantling of unjust social structures so that the weak of this world may be set free to grow as complete human beings [10].

I would like to cite the grand project Gawad Kalinga, GK 777, of the Couples for Christ. The goal is to build 700,000 homes in 7,000 communities in 7 years. I am personally much inspired by generosity and sharing so visible in this effort. It started as a small community project in the slums of Bagong Silang several years ago. Today it is in several hundred communities all over the Philippines. GK does seek to promote "faith communities," but it does not proselytize and reaches out to all faiths. There are several vibrant GK Muslim communities in Mindanao. It fuses faith values with traditional Filipino values of *bayanihan* and *malasakit*. These are faith communities then that are modernizing forces, not self-enclosed, but open to all and to the future.

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THE HUMANITIES IN OUR INTELLECTUAL AND CULTURAL LIFE

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Abstract

Forty-five years after C.P. Snow's famous and contentious lecture at Cambridge on "The Two Cultures," of the humanists and scientists, we continue to suffer, not so much from this dichotomy in our ways of thinking, but rather from their shared subservience in this country to a third "culture," the culture of politics, of base survival and self-interest from the lowest to the highest levels of our government and society.

If our critical faculties were truly at work, the Filipino humanist should have no trouble concluding that the way forward – culturally and economically – can only be led by a greater awareness and application of science in our national life, especially in our education.

But rational decisions like this are held back by the supervening claims of politics, which are neither humanist nor scientific, and by a naïve and retrograde conception of science and humanities as options – mutual exclusivity, and bordering on frivolous – rather than imperatives.

The humanities, in particular, are often taken for a little more than entertainment, a belletristic indulgence devoid of rigor and practical significance.

The question to ask should really not be where the humanities might be located in our intellectual and cultural life – something for which I suspect we already know the answers – but rather where intellect and culture belong in our national consciousness.

Keywords: third culture, humanities, cultural life, science

It is a commonplace—practically a cliché—to say that our lives, and certainly our learning, would not be complete without some appreciation of the humanities. Our

tradition of liberal education has primed us to the necessity of cultivating the "well-rounded individual" schooled in the basics of various disciplines. At the University of the Philippines, and in many other leading universities, we take this as an article of faith, and I see little need for belaboring the point of why a balanced education is a good thing.

But all the same, let me address the subject by way of introducing other related and somewhat broader subjects: the relationship between science and the humanities in our country and culture, including politics and governance, and the position and the promotion of science within our national culture.

First, what exactly do we mean by "the humanities"?

A typical definition of the humanities (employed by the writing program of Colorado State University [1]) describes them as "the branches of learning (such as philosophy or languages) that investigate human constructs and concerns, as opposed to natural processes.... [They] have the overall goal of the exploration and explanation of human experience.... In most disciplines in the humanities, written texts are extremely important, especially in history, philosophy, and literature. Historians attempt a systematic documentation and analysis of events related to a particular people, country, or period. Literary authors and artists attempt to capture for others their own human experiences and understanding of the world. The humanities involve inquiry into consciousness, values, ideas, and ideals as they seek to describe how experiences shape our understanding of the world."

Second, why are the humanities important?

Again I will turn to conventional wisdom and quote what should already be obvious, from the Massachusetts Foundation for the Humanities [2]:

"The humanities enrich and ennoble us, and their pursuit would be worthwhile even if they were not socially useful. But in fact, the humanities are socially useful. They fulfill vitally important needs for critical and imaginative thinking about the issues that confront us as citizens and as human beings; reasoned and open-minded discussion of the basic values that are at stake in the various policies and practices that are proposed to address these issues; understanding and appreciating the experiences of others, and the ways in which the issues that confront us now have been understood in other times, places, and cultures.

"The humanities concern themselves with the complete record of human experience—exploring, assessing, interpreting, and refining it, while at the same time adding to it. We need the humanities. Without them we cannot possibly govern ourselves wisely or well."

What strikes me here is the word "govern," which seems to me to be of utmost importance to us at this juncture of our history, and which is key to our topic today. The role of the humanities in our intellectual and cultural life is to enable us to govern ourselves wisely and well. They deal with issues and value judgments, with defining the commonalities and differences of human experience, hopefully toward an affirmation of our most positive human traits, such as the need to work together as families, communities, and societies. In sum, they help us agree on a common stake, based on which we can make plans, make decisions, and take action.

To move into a somewhat more slippery area, the humanities presuppose and are invariably bound up with the promotion of what we call culture.

In an essay titled "'The Only Responsible Intellectual Is One Who Is Wired,'" John M. Unsworth [3] refers to the critic Raymond Williams who observed how "culture" started out as a verb before becoming a noun. The verb returns us to the Latin root, *colere*, meaning "to inhabit, cultivate, protect," leading to derivatives like "colony" and "couture."

Unsworth adds, quoting Williams, that "The modern sense of the word 'culture' as an independent, abstract noun describing 'the works and practices of intellectual and especially artistic activity' does not become common until the mid-19th century, developing slowly and... organically from the original meaning of cultivating natural resources."

Indeed, Williams reaches much farther back to John Milton, who (in the revised version of his 1660 essay on "The Readie and Easie Way to Establish a Free Commonwealth") wrote of spreading "much more Knowledg and Civility, yea, Religion, through all parts of the Land, by communicating the natural heat of Government and Culture more distributively to all extreme parts, which now lie num and neglected."

Unsworth notes that culture and government are allied by this idea, "yoked to the idea of education as an instrument of social control." It is culture and government that will reach out and bring their "natural heat" to bear on the numb and neglected extremities of the body politic.

This view of government and culture working together as a therapeutic agent is interesting, precisely because it highlights what we seem to lack—especially in this aftermath of one of the most divisive elections in our history. Despite all the predictable rhetoric (and the real need) for national reconciliation, we find it difficult to reconcile beyond short-term political expediency because we remain unable to agree on our most common ideals—the national dream, as it were, or the direction of the national narrative. What is our story? Who is its hero? Are we looking at an unfolding tragedy, a realist drama, or a romantic myth?

I ask these by way of suggesting that one of culture's aims and ways of healing—of assuaging the momentary pains of political separation and material want—should be to remind us of something larger and worthier than ourselves, something worth living and dying for, like God, family, and country. This is a reminder that the

humanities—the academic fount of culture—can deliver, and this is the contribution it can make to the forging of a national culture that will embody and promote a hierarchy of shared values and concerns.

What is important to us as a people? Where do we want to go? What price are we willing to pay to get there?

It will be the humanities that will provide that vision, in all its clarities and ambiguities; and it will be science and technology that will provide the means.

This does not mean that scientists and technologists will have little or nothing to contribute to the crafting of this vision; I firmly believe scientists should, and that one of our worst weaknesses has been the fact that we have left national policy to the politicians, the preachers, the lawyers, the merchants, and the journalists.

The recent elections and our experience with surveys demonstrated the deep discomfort and mistrust with which many of us continue to receive the fruits of science. It is a suspicion, of course, bred of ignorance, but it offers plaintive proof of how far we need to go to propagate a culture of science in this country.

Ours is an appallingly innumerate society. Most of us do not know the simplest numbers that describe our lives, and much less what they mean. We are raised on concepts like the national flower and the national bird and the national tree, but even in college we are hard put to say what the national population, the national birth rate, or the Gross National Product is. Our notion of culture consists of pretty images, pleasant melodies, dramatic gestures, and desirable objects—certainly not puzzling or disturbing numbers.

It is possible that most of us see numbers, especially big ones, as irrelevant to our lives because we feel so small and so alone. What does a trillion-peso debt matter to those who can barely make P200 a day?

Science, of course, is more than numbers. I would like to see it as a belief in a natural order of things and in the efficacy of the process by which that order can be limned and understood. This viewpoint or method is even more difficult to introduce and to embed in public policy or governance, and in its mirror in the public sensibility and imagination. Public debates—even on matters of public health or safety, such as those that have to do with contraception, AIDS, GMOs, incinerators, nuclear energy—are often driven not by the scientific facts, or their rational interpretation, but by political, religious, and economic considerations.

This is not to say that political, religious, and economic considerations are non-essential; to the contrary, they apply the values by which we define ourselves as individuals and as human communities to the issues at hand. Indeed there will be a point when political or moral standards must prevail to preserve a measure of social order, even as we understand that these standards will keep changing over time. But the decisions we make as a people and our own collective intelligence can only improve if they were informed and enhanced by the knowledge available to science.

I neither mean to imply that science is a fixed star, an immutable monolith, or, God forbid, a religion unto itself. Again—often thanks to ignorance—it is easy to push science to an extreme where it acquires a malevolent aspect. Our deep-seated fears of uncontrollably mutant micro-organisms, of nuclear annihilation, of science gone amuck, are presaged in that body of medieval lore called *Faustiana*, having to do with the legendary Dr. Faust, the prototypical mad scientist who sold his soul in exchange for the key to the mysteries of knowledge. Faust would later metamorphose into Dr. Frankenstein, Dr. Strangelove, and any number of amoral explorers of the unknown—including, most recently, *Spider-Man 2*'s Dr. Octopus. It is almost too easy to caricature the scientist as the quintessential villain of modern times, and to depict science as the work of the devil, especially in a society still ruled in many ways by superstition.

Still, and because of this, **science must fight for its place in the popular consciousness, and certainly in policymaking.** Whether we are talking about birth control, Bt corn, the bridge program, SARS, or election surveys, scientists must make their voices heard by the public at large, and they should get all the help they can from the media. In UP, we are making a small but significant effort through a regular feature that has just started in the *Philippine Star*—a weekly column called “Star Science,” which is being contributed by a group of leading UP scientists, who were organized to write about science-related topics in an accessible, popular style.

And the work of bridging the humanities and the sciences must start among us. Forty-five years after C. P. Snow's famous and contentious lecture at Cambridge on “The Two Cultures,” we continue to suffer to some degree from this dichotomy of interests.

Except in academe and in laudably special conferences such as this one, very little formal contact exists between Filipino scientists and humanists (I am employing these terms liberally, and the social scientists can situate themselves wherever they feel more comfortable, if they will not accept Snow's definition of them as the “third culture”).

And even in academe, the only thing that often binds scientists and humanists together are issues of academic and national politics; rarely are the two mindsets brought to bear on the same subject or problem, and rarely do they seem to converge.

C.P. Snow revisited—the debate continues

I do not mean the usual admonitions for the scientists to read Shakespeare and for the humanists to understand thermodynamics, as C. P. Snow seemed to suggest, but rather to argue for more debate and discussion within the university on matters of national significance, informed by viewpoints across the disciplines, so that we inform each other first, and inform each other as well.

Speaking of Snow, it might be interesting if not helpful to revisit some of his points [4, 5], and I will mention just a few:

1. "Literature changes more slowly than science. It hasn't the same automatic corrective, and so its misguided periods are longer." Snow says that scientific analysis is inherently more reliable because it invites and accepts immediate validation.
2. "[Scientists] are inclined to be impatient to see if something can be done; and inclined to think that it can be done, until it's proved otherwise. That is their real optimism, and it's an optimism that the rest of us badly need." Snow suggests that unlike the avatars of what he calls "traditional culture," scientists are inherently optimistic.
3. "There is a moral component right in the grain of science itself, and almost all scientists form their own judgments of the moral life." Not only are scientists optimistic; they are also morally minded.
4. "It is bizarre how very little of twentieth-century science has been assimilated into twentieth-century art." And when science gets used in art, Snow says that it is more often used wrongly, as with the term "refraction."
5. "[Humanists] give a pitying chuckle at the news of scientists who have never read a major work of English literature. They dismiss them as ignorant specialists. Yet their own ignorance and their own specialisation is just as startling." This is where Snow challenges people like writers or professors of literature to explain the second law of thermodynamics, which he argues is just as basic to human knowledge as anything Shakespeare ever wrote."

These were, of course, profoundly provocative if not belligerent statements to make, and they served their purpose in generating a storm of academic debate that has not died down in five decades. One of the earliest and most scathing responses came from the literary critic F. R. Leavis, who—after dismissing Snow's "incapacity as a novelist [as] total"—proceeds to attack Snow's arguments with what wincing onlookers described as "reptilian venom" [5]. Leavis may have indeed been too apoplectic for his position's own good, but cooler heads would later say the same thing: that Snow's arguments, while seeming to be urgent and significant, were terribly muddled, and pandered to a debased notion of culture.

The Snow-Leavis controversy was, of course, just the latest incarnation in its time of an age-old debate that goes at least as far back as the 17th century, to Bacon and Descartes. At the core of the debate, as R. S. Crane [6] among others has noted, was the question of by what kind of knowledge we are best served—to oversimplify it somewhat, whether by love poems and fables or by the observation of natural phenomena. That debate would be followed in the 18th century by another tiff between the so-called Ancients and Moderns.

We need all kinds of learning

Today, we have more or less come to the sensible conclusion that we need all kinds of learning, albeit from different individuals, and embed a little of everything in every individual. Thus we have, in UP, the general education program that all our students take prior to specialization.

We teachers often complain that our students never learn enough of what we expect them to learn. In the humanities and the social sciences, we deplore the poor preparation and cultural illiteracy of students, who cannot write complete and cogent sentences, read maps, cite important dates and events, and appreciate music more than five years old. But I suspect that even more work needs to be done on side of science and mathematics.

If our critical faculties were truly at work, the Filipino humanist should have no trouble concluding that the way forward—culturally and economically—can only be led by a greater awareness and application of science in our national life, especially in our education.

We expend so much energy arguing about whether we should be using English or Filipino as our primary medium of instruction, but sadly this impassioned debate does not seem to have been matched by a comparably emotional investment in science and math. I emphasize the word “emotion,” because it is quite often the gateway to our reason and then our imagination, and unless complex issues and concerns are expressed in personal terms and personal stakes, it is difficult to engage the public in matters of national policy such as S&T development.

Like the arts, science must matter in the news, in the popular imagination, and in public policy

In the humanities, we are helped at least by the higher public profile that has recently been given to our National Artists like the late Nick Joaquin (and never mind that most of them seem to be dead or dying). Artists are creatures of media, and we have a built-in support system that tends to focus attention on our own luminaries. While the public at large would still be hard put to name three National Artists, I doubt that even your typical UP sophomore can name one National Scientist, dead or alive.

Call them “poster boys and girls,” but we need this kind of media-savvy promotion of our highest achievers, both to create role models and also to raise the bar of intellectual achievement. Our people must know that there are other, worthier pursuits than to become a politician or a movie star—or both. Like the arts, science must matter in the news, in the popular imagination, and in public policy.

Unfortunately, we all have to deal with the supervening claims of politics, which are neither humanist nor scientific. Indeed, we do not suffer so much from the “two

cultures", but rather from their subservience in this country to a third "culture" (with apologies to Snow and the social scientists)—the culture of politics, of base survival and self-interest from the lowest to highest levels of our government and society. Politics is keeping us from thinking straight—whether scientifically or humanistically. Our most recent attempts to get a scientific handle on how we think as a body politic—through an instrument that editorialists spoke of in almost derisive terms as "the survey"—met with more resounding skepticism than we normally reserve for voodoo and UFOs.

Thanks to the successful co-optation of the intelligentsia by the political powers that be, there is no real incentive to be learned; one only has to be smart to get ahead. Many of our leaders are either poorly read, or corrupt enough to ignore what they have read.

Our intellectual growth has also been retarded by a pedestrian conception of science and the humanities as afterthoughts—bordering on the frivolous—rather than national imperatives. The humanities, in particular, are often taken for little more than entertainment, something for one's leisure and amusement, a labor and a profession only to their purveyors, rather than a handle on life's affairs as practical and as sturdy as any other.

So, where lies the hope, if any, for a more enlightened view and a stronger articulation of the concerns of Philippine humanities and science?

As ever, the hope must lie in education, with us, among ourselves, and then from us to the people at large. It seems almost too facile and typically academic to suggest in a symposium that the answer lies in more symposia, but it does. We need to talk about how massive social problems like poverty, hunger, injustice, and illiteracy can be approached from our respective disciplines, and how our perceptions can be reintroduced into the classroom, the laboratory of our intellectual future.

We must go beyond the school. To go back to my earlier point, if the humanities are to help us govern ourselves wisely and well, they must reach out to all sectors, especially the poor. Better libraries, better movies and television, and better access to the Internet would be a good start.

We must learn to use the mass media, print and electronic alike. Scientists, especially, must weigh in with their opinions, and project themselves as thinking personalities with names and faces whom ordinary people can identify with. This comes perilously close to proposing that academics engage in popular politics, but at least some of us should; many of us are already engaged in or by NGOs. The right voice in the right committee in Congress could do more for our people than a number of funded research projects.

Science and the humanities are coming back together in digital culture

Finally, the most fertile common ground for science and the humanities may yet be information technology—and not only in the way it spreads information quickly and widely, but precisely in the way it works. Science and the humanities are coming back together in unexpected ways in digital culture. In a paper that pays homage to what he calls “digital culture” and “the rise of the digital demotic,” Prof. Lou Burnard [7], a former English teacher who learned to write code and later became Assistant Director of Oxford University Computing Services, observes that “Digital systems foster, embody, and support a fragmented, nonlinear, decentered, view of text and textuality which seems strangely congruent with current thinking about such phenomena; which is cause and which effect I would not presume to judge, but current cultural perspectives are inherently digital... The computer offers those interested in the use of language itself incomparably better tools than we have had hitherto; in particular, they enable new kinds of evidence and new methods for their assessment and incorporation into language teaching; particularly in Europe, where multilinguality is a major political desideratum, this means that language processing technologies are central to the concerns of the state as well as those of the academy.... Digital techniques offer us a cheap and universal medium for the description, distribution, and analysis of all kinds of pre-existing cultural artefacts.”

Some of us are privileged today to be caught up in this nexus of new discoveries and opportunities enabled by spectacular advances in technology and by the more salutary aspects of globalization. Let's hope we can bring more of our people into this brave new world—after we draw its map, and locate ourselves in it.

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EXCHANGE-RELATIONS, ECONOMIC HISTORY AND PHILIPPINE INSTITUTIONS

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Abstract

Institutions have come to be recognised among the “deep determinants” of economic development. Institutions are defined [7] as “social factors – rules, beliefs, norms, and organizations – that guide, enable, and constrain the actions of individuals, thereby generating regularities of behavior.” Institutions surrounding and affecting exchange are particularly important in economic development in light of the principle that in giving rise to specialisation, exchange promotes productivity growth. Both in history and in principle, an expanding scope of exchange creates a demand for impersonal rules that go beyond immediate personal relationships to include more comprehensive common responsibility systems, and on to third-party enforcement mechanisms including the state.

This paper contributes to the hypothesis that a good deal of past Philippine under-development was due to the restriction of trade, and, more importantly, that such a restriction bore consequences for the subsequent development of Philippine institutions. The Spanish conquest suppressed the pre-existing free trade that existed between native communities and China and the South, replacing this instead by the mercantilist institutions, notably the galleon trade. For a great part of the Spanish occupation, domestic trade itself was also discouraged through arbitrary impositions, confiscation of goods by the colonial authorities, as well as the mis-guided formal restriction of credit transactions. The effect was not merely to severely limit wealth-generation among the native population of the time, but more importantly to prevent the emergence of institutions that would facilitate impersonal exchange separated in time and covering long distances. In particular, an experience of effective and impartial law failed to develop. What law there was, as embodied, e.g., in royal ordinances, failed

to correspond with facts on the ground and was violated arbitrarily by colonial officials and agencies.

It is then suggested that from this pattern may have originated some of the problems that plague even current Philippine institutions, including the continuing reliance on exceptions-based personal relationships rather than on impersonal rules, the weak definition of property rights and enforcement of contracts, and the lack of restraints on the actions of the powerful actors and hence their inability to make credible commitments.

Keywords: institutions, trade restrictions, development, exchange-relations

Whenever commerce is introduced into any country, probity and punctuality
always accompany it.

— Adam Smith

[Lectures on justice, police, revenue and arms Part II, par. 17]

The most commercial and most industrious countries have been the freest
countries.

— José Rizal

"The indolence of the Filipino"

Contemporary political events have thrown the quality of Philippine institutions into sharp relief. Over the last four years and in very short order, the mettle of the nation's institutions has repeatedly been tested by such events as the impeachment and unseating of a president, an aborted impeachment of country's chief justice, and a national election unprecedented in the rancour of its conduct and subsequent canvass.

In each of these instances, the adequacy and seriousness of the country's most basic rules as contained in its basic laws and procedures have been tested to the limit, often dangerously. The question has thus been asked whether a genuine social consensus indeed underlies the formal rules that purport to govern public behaviour. Writers such as Hutchcroft and Rocamora [7] would refer to a "democratic deficit" in the Philippines – by which they mean a gap that exists between formal institutions and the perceived needs of people. Deep questioning regarding the nature and quality of Philippine institutions is not new, of course. A good deal of writing in political science and political economy deal with the notion that the credibility and adherence to institutions is weakened by the fact that the political system is unresponsive to the majority, and that much of this has to do with inequity in the distribution of income, wealth, and education. Without denying the importance and possible interdependence

of these factors, however, there should be room for a finer distinction between social equity on the one hand and the rule of law on the other. There are societies where the rule of law may prevail, even wealth may be unequally distributed (e.g., the United States), while those also exist where rough equality prevails but the rule of law may be weak (e.g., Zimbabwe).

In this country, what is apparent is a weak constituency for and acceptance of rules. Rules even before they have had the chance to ossify, are the subject of challenge through acute innovation, whether the rules have to do with an impeachment, a canvass, or contracts to build an airport, reclaim lands, buy vote-counting machines, and so on.

This paper's general hypothesis is that an important part of the institutional problem in the Philippines is the disconnect between formal institutions and informal ones, using the distinction made originally by North [2]. Formal institutions are constraints on behaviour that embodied in constitutions, laws, statutes, and written contracts and are in principle enforceable by the state. On the other hand, informal rules and constraints consist of unwritten norms of behaviour that people observe for their own convenience and benefit, however these may be defined. What is important is that these in principle require no intervention on the part of the state to make them effective; indeed they may at times involve behaviour that is technically illegal. But their existence and enforcement rely on no more than the beliefs of the actors, or on the real or imagined retaliation or consequences following upon their non observance.

For the Philippines, an important first clue to using history to trace the disjunction between formal and informal institutions dates back at least to O.D. Corpuz's, who in his valuable but now little-noticed book of 1965 [3] (subsequently reiterated in Corpuz [4]), noted how, in order to escape the harshness of the colonial order, many subjected Filipinos developed the habit of dissimulation, i.e., of complying outwardly with formal rules while continuing to adhere to informal but often more compelling norms that pre-existed the occupation:

The potentially violent competition between Christian dogma and folk belief was resolved through the process of selective acceptance and mutual accommodation... The political and economic demands of the colonial regime upon the masses of the Filipinos through partial compliance and occasional evasion ...

.....

When their behaviour would be visibly contrary to the colonial requirements, the complied in order to avoid punishment. But they took advantage of every occasion to live under the morality of pre-Hispanic society [3]

.....

Thus the Filipinos shaped and created, in myriad ways, an independent life of their own, misunderstood by the Spaniards because they did not share that life; the Filipinos retreated to this life to escape the severities of the colonial order [3].

In these passages, Corpuz [3] presents a valuable insight into why the institutions of colonial government failed to take root and attain credibility in the Philippines. Essentially, he implicitly points to a competition between formal institutions and pre-existing informal ones. In this competition, however, it was the formal one that lost out. Drawing this strand through to the 20th century, Corpuz noted how the default institution of the family (or the clan) thus became juxtaposed to state institutions and how their competing value systems often clashed. This he uses as a partial explanation of the phenomenon of corruption that runs like a thread through all epochs of Philippine history.

What follows seeks to pursue the line of reasoning O.D. Corpuz has begun. We seek both to generalise as well as specify the argument, however. We generalise it by recasting a good deal of historical writing into the language of the new-institutional economics. By this means we hope to gain a better insight into those peculiar factors that prevented formal institutions in the Philippines from developing and gaining credibility and acceptance. At the same time, given the vastness of this topic, we have chosen to focus only the institutional aspects of commerce. This article hypothesises that historically the underdevelopment of Philippine economic institutions is at least partly traceable to the country's long history of suppressed trade. To lay down this hypothesis, however, we first discuss the inherent institutional problems posed by exchange in general.

Institutions and the problem of exchange

Beyond instantaneous or spot-transactions (*kuliwaan*), the basic problem of exchange has to do with the absence of guarantees of compliance. This is especially true of complex exchange [2], that which is separated in space or time, or, as Greif [5] [1997] puts it, where the "*quid* is separated from the *quo*". Credit is a canonical example: it involves the transfer of physical possession over some asset, whether a concrete good or money, to some other person, in exchange for a promise to replace this in the future with a larger value. What Greif [6] has called the "one-sided prisoner's dilemma" with respect to such exchange has to do with the real possibility that the debtor will choose to abscond with the asset and fail to keep his promise to repay with interest. Indeed, cooperation, as North [2] puts it, presents a theoretical problem.

Suppose the potential gains from trade are $p > 0$, and that if exchange is consummated, the gains are split between two Persons A and B, with each obtaining $p - c > 0$ and $c > 0$, respectively. Should no exchange take place, each gets 0. On the other hand, if Person A initiates exchange and B accepts but later reneges on the promise, the former obtains $v < 0$, while the latter obtains $r > c$. These results are summarised in Tables 1 and 2 below, which is an alternative representation of Greif [7].

Table 1.1 Person B's choices if A initiates exchange

A initiates exchange; B refuses	A initiates B accepts and complies	A initiates; B accepts and reneges
0	$p - c$	$v < 0$
	0	c
		$r > c$

Since $r > c > 0$, B's dominant strategy is to renege on the agreement if A initiates exchange, which under full information can be regarded as a certainty by A. Using backward induction, therefore, A's decision whether or not to initiate exchange takes the following form:

Table 1.2 Person A's choices

Do not initiate exchange	Initiate exchange
0	$v < 0$
	0
	r

In such a situation, the dominant strategy for A is clearly not to initiate exchange at all (since $v < 0$). Hence, the only sub game-perfect equilibrium is for exchange not to occur. Thus game theory suggests there is no persuasive solution to any one-period Prisoner's Dilemma as it is presented above.

The path towards a solution takes essentially two forms. The first relies on the notion of repeated games, which essentially takes us away from the one-period dilemma. If instead of a one-period transaction, Person B can look forward to many repeated transactions indefinitely in the future, then the gain from reneging in a particular game in any single period may be outweighed by the loss of future repeated transactions. To picture this most directly, suppose that the value of future transactions for B at any one period is C rather than c , with $C > r > c$. Then it becomes evident that the dominant strategy for B would be to comply with the terms of the contract (Table 2.1). Correspondingly, the table of A's payoffs is also revised to reflect the certainty of compliance, and therefore the dominance of the initiation of exchange (Table 2.2).

Table 2.1 Repeated exchange: Person B's choices if A initiates exchange

A initiates exchange; B refuses	A initiates B accepts and complies	A initiates; B accepts and reneges
0	$P - C$	$v < 0$
	0	$C > 0$
		$r < C$

Table 2.2 Repeated exchange: Person A's choices

Do not initiate exchange		Initiate exchange	
0	0	$P - C$	$C > 0$

It is not noted frequently enough that Adam Smith [8] long ago saw the importance of repeated transactions (though not in the *Wealth of nations*), when he observed the changes in culture introduced by a society's opening up to regular commerce.

Whenever commerce is introduced into any country, probity and punctuality always accompany it. ... A dealer is afraid of losing his character, and is scrupulous in observing every engagement. When a person makes perhaps 20 contracts in a day, he cannot gain so much by endeavouring to impose on his neighbours, as the very appearance of a cheat would make him lose. Where people seldom deal with one another, we find that they are somewhat disposed to cheat, because they can gain more by a smart trick than they can lose by the injury which it does their character.

..... Wherever dealings are frequent, a man does not expect to gain so much by any one contract as by probity and punctuality in the whole, and a prudent dealer, who is sensible of his real interest, would rather chuse to lose what he has a right to than give any ground for suspicion. Every thing of this kind is (as) odious as it is rare.

The second possible solution to the one-sided prisoner's dilemma is the emergence of *third-party* enforcement, that is, an entity other than either contracting party is called upon to exact a penalty for any non-compliance. Historically this has usually taken the form a legal system enforced by the state. In terms of the pay-off matrices in the two-stage game, this may be depicted as a penalty on B in the case of failure to fulfil his end of the bargain. The penalty k should reduce the gains to reneging sufficiently so that they are less than the gains to complying, i.e., it should be set so that $r - k < c$, or such that $k > r - c$ (Table 3.1). To the extent this suffices to make compliance the dominant strategy for B, the payoff matrix for A's first move is revised accordingly as well (Table 3.2).

The difference between this and the previous case, of course, is that third-party enforcement does not rely on repeated transactions. While repeated transactions require frequent contact and the acquisition of information between the exchange-parties, third-party enforcement in principle applies even to exchange between anonymous parties and should operate even if exchange does not proceed beyond a single transaction.

Table 3.1 Third-party enforcement: Person B's choices if A initiate changes

A initiates exchange; B refuses	A initiates B accepts and complies	A initiates; B accepts and reneges
0	$p - c$	$v < 0$
0	c	$r - k < c$

Table 3.2 Third-party enforcement: Person A's choices

Do not initiate exchange	Initiate exchange
0	$p - c$
0	$c > 0$

The difference between this and the previous case, of course, is that third-party enforcement does not rely on repeated transactions. While repeated transactions require frequent contact and the acquisition of information between the exchange-parties, third-party enforcement in principle applies even to exchange between anonymous parties and operates even if exchange does not proceed beyond a single transaction.

Trade and institutions in other contexts: Maghribis versus Genoese

Beyond the conceptual literature, the nexus between exchange and the emergence of institutions has also been the subject of historical investigation by a growing number of authors (e.g., North and Greif) who find that the two types of solution to the exchange problem adverted to in the previous section, i.e., mutually enforcing agreements (or second-party enforcement) and state enforcement, are to be observed in history.

The similarities and differences between these two modes is provided by Greif [5, 7], who studied the differences in trading practices between two medieaval trading communities. The Maghribis of the 11th century, Jewish merchants who lived as a minority under military Muslim rulers (specifically Berbers in Egypt and Turks in Turkey) relied primarily on reputation-based mechanisms that consisted of self-enforcing informal agreements among themselves. Copious information-sharing and horizontal relationships among themselves helped the Maghribis solve the inherent risks posed by the handling of a merchant's goods in long-distance trade. Maghribi merchants in different ports and countries would act as agents, receiving and selling goods for their compatriots who would otherwise be far-removed physically from the transactions that occurred. These merchant-agents in turn expected their colleagues in other cities to perform similar in their behalf in their turn. The threat of embezzlement by people acting in one's behalf was obvious. But ultimately, credible enforcement, in the form of a system of a system of cross-defaults and boycotts of agents who had been

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dishonest, was used successfully to enforce "probity." It is significant that in the process the Maghribis relied not on legal documents but only on the value of long-standing relationships of trust and honesty.

Greif contrasts the Maghribis' trading practices with those of contemporary Genoese merchants. From the beginning the Genoese had tended towards a more individualistic ethos—in contrast to the Maghribis's collectivist cultural beliefs. Unlike the Maghribis, who were a minority under foreign military rulers, the Genoese had themselves established an effective government that was under the merchants' control.¹ Genoese merchants did not share information with each other, did not rely on collective punishment, and also did not restrict their dealings to fellow-Genoese. Instead, there was a clear delineation of functions and obligations as between merchant, agent, and ship-owner, a delineation that was reaffirmed by the Genoese invention of trade documents such as the bill of lading and the bill of advice [5]. In such an individualist society,

[a]n agent who embezzled goods would not be recruited by the cheated merchant again, but could become a merchant himself, able to utilize agents under the same conditions as the merchant he had cheated. Hence, only if agents' wages are so high that anyone prefers being an agent rather than a merchant can agency relations be established. In other words, for agents to be employed, the merchants have to pay them all the profit and a part of the capital. Clearly there cannot be an equilibrium with such a wage. Hence, for agency relations to be established, there is a need for an external mechanism – such as a legal system backed by the state – that restricts agents' ability to embezzle merchants' capital [5].

Ultimately the Genoese legal system developed to register and enforce contracts, developing permanent courts to decide cases, and using the state to enforce penalties among both Genoese and foreigners alike, so that "the city of Genoa functioned as a formal enforcement organization to make the threat of collective retaliation credible" [5]. Among others, this included the threat of confiscating the wealth of the Genoese offender's family or their imprisonment, as well as the retaliation by the government against compatriots of offending foreign traders.

Between these two, there are gradations, of course. An interesting halfway house between state-enforced rules and mutually but informally agreed conventions was the emergence of the mediaeval "law-merchant" (*lex mercatoria*). Merchants of differing nationalities who became involved in disputes during fairs (e.g., the famous fairs at

¹ Among other things, the Genoese republic entitled all adult males to vote, and in 1194 the system entailed hiring a non-Genoese for a limited period to be responsible for protecting property rights and operating the legal system. This level of accountability was not unique. The control by merchant classes over governments was apparently also true in many Italian cities during the period [5].

² The *piepoudre* (or *piepowder*) courts in England were the lowest form of court using the common law and adjudicated disputes during fairs. The term itself originated from the French *pied-poudré*, or powdered feet, because these were often held outdoors on the spot, with the litigants often coming in dusty shoes.

Champagne) would resort not to the local law but to a common body of custom adopted and accepted by merchants of differing nationalities and adjudicated by peers without recourse to existing state authorities. While the form by which such a body of law was implemented resembled third-party enforcement, e.g., ultimately involving specialised courts and judges¹, and while it facilitated impersonal exchange [2] the ultimate basis of such practices in mutual agreement and self-enforcement and its nature as voluntary arbitration was evident. A native merchant from country A could certainly have asked the local ruler to intercede (fairly or unfairly) in his behalf versus a colleague from country B, inevitably gaining the upper hand in the process. While the immediate benefit to such an action was evident, however, there would clearly be a long-run loss in the form of ruining one's reputation and hence prospects for doing further business. This underscores the truth in A. Smith's earlier-cited assessment that a merchant "sensible of his real interest, would rather chuse to lose what he has a right to than give any ground for suspicion". The law-merchant was notable, first, in that it asserted equality before the law, making it "a path-breaking deviation from the feudal class law" [9]. Second, of course, the law merchant notably came to be adopted by governments as forming part of their formal laws, with the state's enforcement mechanisms holstering what were previously commonly agreed rules.

We are thus able to state the hypotheses flowing from a consideration of exchange and institutions in principle and in other historical contexts:

First, for exchange to proceed beyond spot-transactions, the bad-Nash equilibrium of exchange needs to be solved either by self-enforcing agreements that presuppose repeated transactions, or by third-party enforcement that will typically take the form of legal sanctions by a state.

Second, the gains from exchange themselves constitute a powerful incentive to establish such institutions; as a corollary, the absence of such sizeable gains from regular exchange will effectively diminish the demands for institutions of either type. If the prospective gains from trade are small, neither the costs of information-gathering and -sharing required for a network of relations to implement self-enforcing agreements, nor the resources needed to establish the mechanisms of impersonal government will be justified.

A *third* hypothesis concerns the factors that determine whether societies and groups tend towards formal and legal state-enforcement or informal mutual guarantees based on reputational mechanisms. While answers are far from complete in this regard, Greif [5] suggests that the outcome may depend on: (a) the cultural starting point, whether the group in question cultivates collectivist or individual traditions, and (b) whether the community occupies a dominant or minority position in the existing political system. The Maghribis were nurtured in a collectivist tradition and therefore already possessed the kind of "social capital" that – spread out over this small group

¹ Understanding social capital as a species of "fixed cost," it becomes plausible that costs first decline before they rise as the size of the group increases.

- permitted low costs of gathering and sharing detailed information about each other⁴, as well as of sanctioning its erring members through informal means. Not so the Genoese, whose individualistic traditions made such information-gathering costly and whose weaker social bonds also made it difficult to elicit cooperation with informal sanctions such as communal boycotts and shunning which require consensus. Under these circumstances, enforcement by a state may prove more expeditious.

Collectivist and individualist societies have distinct "demands" for a state. In particular, an individualist society, but not a collective society requires a government with the coercive power and administrative structure required to be able to confiscate individuals' wealth and imprison them in case of need. Yet the ability for this demand to be fulfilled without undermining the economic growth by its own existence depends on the process through which the government is "supplied". When a strong government exists, to advance economic exchange and performance, effectively it should be able to commit to the security of private property rights. In the absence of such commitment, individuals would refrain from using the legal system to support exchange, fearing predation [5].

As for the second point, namely the group's position in the political system, the Maghribis were a minority, Jews in predominantly Muslim societies, while the Genoese claimed full birthright in their cities and were therefore in a better position to exact guarantees and check possible abuses from their government. For this reason, communities like the former, more so than the latter, will have found it more hazardous to seek to apply existing legal state-enforced mechanisms. One may hypothesise, then, that collectivist groups who are in minority or subordinate positions (indeed their subordinate social status may feed back and encourage their refuge in mutual protection) are more likely to subsist in informal, mostly reputation-based, arrangements. On the other hand, a resort to legal and state-enforced remedies may be more likely as a more individualistic ethos spreads, and to the extent socially dominant groups are involved.

Suppressed trade and the weak demand for impersonal institutions

It now remains to inquire whether and to what extent this framework applies to Philippine history and institutions. A hypothesis of this paper is that a principal reason that the demand for more impersonal institutions in the Philippines failed to develop was the suppression of trade under the long period of the Spanish conquest.

There is tantalising albeit fragmentary evidence of incipient complex exchange taking place in the Philippines in pre-Hispanic times. To demonstrate his point that his

⁴ Rizal [10] apparently used the earlier translation of the 13th century manuscript made by Friedrich Hirth, "Zur Geschichte des Orienthandels im Mittelalter," *Globus* 56 (15) September 1839:238.

countrymen were involved in an "active trade not only among themselves but with all the neighbouring countries" before the Western contact, José Rizal [10]⁴ cited Chau Ju-Kua's in "Records of various barbarian nationds" (*Chu-fan-chih*, dated 1225 AD). A later translation of the same document by Wu Ching-hong [11] is paraphrased by O.D. Corpuz [4] to describe the trading relationships between Chinese merchants and early inhabitants of a place called Ma-yi, which several historians take to refer to Mindoro or Luzon.

Chinese traders sail to Ma-yi and cast anchor before a designated trading place on shore. Ma-yi's more than 1 000 families have their houses on banks of the river. The traders give umbrellas as gifts to the native chief. The native traders go on board and carry off the Chinese wares. There is apparently no tally of who of the natives carry off which goods; but the Chinese learn to identify the men, and so nothing is lost.⁵ (Filipinos prefer an older translation, which says that nothing is lost because the natives are honest.) The natives take the goods for barter in other barangays; they return months later and settle accounts by exchanging native products for the Chinese goods. The local products in the trade were "yellow wax, cotton, pearls, tortoise-shell, medicinal betel nuts, and *uta* cloth". The Chinese barter goods were "porcelain ware, trade metals, iron tripod vessels, black lead, variegated glass beads, iron needles, etc."

It is not sufficiently appreciated that this fragment actually depicts complex trade, involving what Greif has called a trade that literally involves the "separation of the *quid* from the *quo*," a case of exchange separated in time. The original document speaks of a period of months⁶ before the natives returned with the proceeds of barter in the hinterlands. This example involves what in modern terms would be equivalent to supplier's credit, a primitive form, but credit nonetheless. It is plausible to expect that the basis for the success of these arrangements was the expectation of repeat-business, and the operation of reputation mechanisms. The presence of repeat business is evident in the fact that "the Chinese learn to identify the men." As previously seen,

⁴ Wu's literal translation of the text reads: "The custom of the trade is that the barbarian traders come in crowds, and carry away goods with them into bamboo baskets. It looks as unable (sic) to understand them at the first sight, when slowly distinguish (sic) the men who remove the goods and nothing will be lost [11]."

⁵ Possibly relying on the German translation, Rizal interprets the account as saying that the natives took the Chinese goods away for distribution and did not return until nine months later ("travelling nine months and returning afterwards"). Wong's [12] version, on the other hand, states that "they (the native traders) did not return until the 7th or 8th month of the year (viz., August or September)", which by itself prevents any conclusion regarding the length of time they were away. Kolb [13], on the other hand, places Chinese traders as typically arriving in March of each year and leaving in May, which may explain Chao's observation that merchants to the south seas were frequently the latest to return.

repeated games are one solution of the one-sided prisoner's dilemma problem, which is certainly what the Chinese would have faced.

This fragment is notable evidence of the fairly complex institutions that may arise in response to trading opportunities, even in the context of barter. Not less than the Maghribis, the thirteenth-century inhabitants of the Philippines and their Chinese partners had evolved an institutional solution to the agency problem in trade that was based on the desire to maintain mutually beneficial repeated transactions. Other passages in the manuscript also suggest that exchange with foreigners was also characterised by a kind of community responsibility system typical of societies built on communitarian principles. This is suggested by the role of the chief in implicitly guaranteeing the transactions.

At the very least, this fragment suggests that the potential existed for developing informal, reputation-based, self-enforcing agreements among some ancient communities in the Philippines. Whether and in what form this would have developed further, and whether some of these could have subsequently – as the Genoese did – branched off towards more a greater reliance on state enforcement is not clear.

Mercantilism

What is undeniable, on the other hand, is that the Spanish conquest precluded any further opportunities for an expansion of such self-organised trading institutions. Guided by a mercantilist policy and partly out of fear of invasion by neighbouring countries, Spain effectively closed off the Philippines to foreign trade except through Manila, and then only to Chinese traders. The fairly open trading regime that had existed hitherto between foreigners and various native communities prior to the occupation was replaced by the centralised and hopelessly limited galleon trade between China and New Spain, through Manila, which was carried on until 1813.

Rizal also condemned the mercantilist policy of suppressing exchange between the Philippines and other countries because it constituted a huge discouragement to effort and hence formed part of the explanation of the Filipinos' alleged "indolence":

Fearing to have the Filipinos deal frequently with other individuals of their own race, who were free and independent, as the Borneans, the Siamese, the Cambodians, and the Japanese, people who in their customs and feeling's differ greatly from the Chinese, the Government acted toward these others with great mistrust and great severity, as Morga testifies in the last pages of his work, until they finally ceased to come to the country. In fact, it seems that once an uprising¹ planned by the Borneans was suspected: we say suspected, for there was not even an attempt, although there were many executions. And, as these nations were the very ones that consumed Philippine products, when all communication with them had been cut off, consumption of these products also ceased. The only two countries with which the Philippines continued to have relations were China and Mexico, or New Spain, and from this trade only China and a few private

individuals in Manila got any benefit. In fact, the Celestial Empire sent her junks laden with merchandise, that merchandise which shut down the factories of Seville and ruined the Spanish industry, and returned laden in exchange with the silver that was every year sent from Mexico. Nothing from the Philippines at that time went to China, not even gold, for in those years the Chinese traders would accept no payment but silver coin. To Mexico went little more: some cloth and dry goods which the encomenderos took by force or bought from the natives at a paltry price, wax, amber, gold, civet, etc. but nothing more, and not even in great quantity... [10].

From the beginning the purposes of the galleon trade were extremely circumscribed. It was meant to provide a livelihood that would sustain the Manila traders, no more, no less. It was a concession within the more general mercantilist policy of preserving both the colonial and home markets for Spanish goods ("the factories of Seville"). Castillo [14] summarises the views of the significant Spanish mercantilist Uztárriz, who favoured limiting the galleon trade between the Philippines and Mexico "because the Chinese infidels and the Mohammedans were reaping the greater benefit of the traffic; draining America of the gold and silver which by right should go to Spain". The mercantilist policy deliberately limited the amount of both Chinese and colonial goods that arrived in the Americas and in Spain in order to preserve the market for Spanish goods. Laws that were implemented strictly beginning in 1593 limited the amount of merchandise carried on the galleons to Mexico, all as part of a policy limiting trade between the colonies:

All Chinese goods imported into Mexico had to be consumed there and shipment of Chinese cloth to Peru was absolutely prohibited, and in 1636 all traffic between New Spain and Peru was interdicted. The object of all these laws is very obvious; they were intended to reserve the American market for Spanish silk [14]

Similarly, Corpuz [4] notes that the underdevelopment of the economy's real sector was actually part of a mercantilist policy:

There was no legal system or official policy to promote either corporate or plantation agriculture because this would entail export of colonial produce, which would violate the narrow perspectives of the galleon trade, which was maintained to support the Spanish shippers of Manila and enrich the merchants of Cadiz and Acapulco – but in the end funnelled the larger part of the profits into the hands of the south China traders [4].

The restriction of trade and the designation of Manila as the only international trading port was logical if the point was to monopolise the market for Chinese goods (effectively lowering their price to the shippers) as well as to restrict the channels for selling these to New Spain (raising their price to the buyers there). The policy amounted to what in modern terms would be called a "voluntary export restraint" which aimed to

meet the twin goals of guaranteeing a degree of profits just enough to sustain the Manila colony while protecting the interests of the home industries.

From the viewpoint of nascent communities in the Philippines, however, the significant impact of these policies was effectively to restrict their links to cross-cultural trade. If anything, it even reinforced a reversion to local autarky and a discouragement of specialisation as the exactions of the colonial authorities placed a strain on food production. In addition, inter-provincial trade and labour movements were severely restricted. The impact of foreign trade on domestic specialisation, notably in agriculture, would not be felt until the reform-schemes of Basco in the late 1700s imposed the cultivation of certain cash crops, notably tobacco, in selected regions of the country.

Recall that the some early Philippine communities had at most reached the point of establishing reputation-based enforcement mechanisms that sustained the long-term informal and personal relationships that supported cross-cultural trade. It would be purely speculative to ask what would have induced further development along the lines of legal, state-enforced rules. Clearly, however, the decline of external trade itself removed any further prospects of advance. For it is typically the need to deal intensively with strangers possessing differing customs and requirements that necessitates the delineation of impartial rules (such as the law merchant) that do not simply favour the native if repeated transactions are to be supported. Where any kind of political authority exists, it must at least commit to being non-arbitrary and nonpredatory, particularly with respect to foreign interests with which it hopes to maintain future dealings. At a maximum, social investment is required to maintain courts, police, and other standing organisations to enforce contracts impartially. The incentive to invest in this type of social overhead would obviously diminish if the extent of trade with foreigners was small to begin with.

Aside from the decline in commerce itself, a second distinct reason that Filipinos native would not have demanded impersonal institutions was their inferior position in colonial society. Above we already cited Greif's conjecture that minorities and subordinate groups – even if they had been engaged in trade like the Maghribis – would have a greater likelihood of relying on informal and personal networks as means of enforcement, rather than on legal rules enforced by the state, in relation to which they were outsiders.

Indeed the indirect evidence that bolsters this conjecture is the Chinese community during the Spanish conquest. The position of the *sangleys* in Philippine colonial society most resembled that of the Jewish Maghribis in Muslim societies. The *sangleys* were engaged continuously in commerce and managed to attain a degree of prosperity, but as a subordinate class, they were always treated poorly by the Spanish regime, with persecution at times taking the extreme form of expulsions and massacres. For apparent reasons, therefore, the legal system of the Spanish regime would not have served them either to enforce contracts among themselves or to register mutual liabilities with either Filipinos or Spaniards. As a result, like the Maghribis, the Chinese

in the Philippines and elsewhere in Southeast Asia sustained their overseas and domestic trading activities by using informal networks based on kinship and geographical origin (hence the almost homogeneous Fujianese origins of Chinese in the Philippines).⁷

It should follow that given their dependence on the Chinese for supplies of traded goods and as a pool of craftsmen, the Spaniards should in principle have had an incentive to smooth out relations with the *sangleys* and have this expressed in their formal legal system. This indeed was the case: Corpuz [4] points out how an entire chapter in the *Recopilacion* (Libro VI, Título 18) was devoted to the Chinese and how such laws “attracted and protected them and regulated their numbers, terms of residence, occupations, as well as relationships with the Spaniards and Filipinos”. The problem, of course, was whether such laws amounted to and were regarded as binding obligations. The absolutist nature of the Spanish regime (both at home and in the colonies) made it difficult to make binding commitments – an issue to be discussed further below – and relations with the Chinese were time and again characterised by a high degree of arbitrariness, vacillating between a loosening of the quotas on immigration and settlement on the one hand, and pogroms and expulsions, on the other.

The *a-fortiori* argument to be made is as follows: if the *sangleys* themselves, who were continuously and intensively engaged in trade, had little incentive to make use of the superimposed Spanish legal system, preferring instead to resort to second-party enforcement, then the *indios* who were cut off from trade had even less reason to do so.

Domestic trade

Domestic trade at first glance might have seemed promising, since the Spanish regime did not in principle prevent natives from engaging in it; indeed they even appeared to reserve this sector for them (shades of retail-trade nationalisation) by prohibiting domestic trading by the Spaniards [4]. The *Recopilación de las leyes* explicitly forbade Spanish officials from engaging in domestic trade.

It was to be expected, however, that such a law would be ineffective, and that instead the real property rights would go to those with the most to gain by it [16]. There was a disjunction between the written law and facts on the ground, a case of what North and Thomas [17] called a lack of correspondence between the property rights and the proper incentives. It was, after all, the *alcaldes* who had both the capital and perhaps the entrepreneurial ability to engage in internal trade. The privileged social and political status of the *alcaldes* thus did not match their deprivation of rights in the law, which assigned this to the natives. Corpuz [4] notes how it became common practice for *alcaldes* to engage in trade, since after all:

⁷ The role of social networks among overseas Chinese in sustaining trade even in more recent times is mentioned in Rauch and Trindade [15].

Nobody could compete with the merchant-alcaldes and governors in their provinces. They were de facto entrepreneurs in local trade, whether overland or the coasting trade, with the friar-traders in the secondary role. This was the reason why the formula of the *indulto para comerciar* had been devised for them in 1751 [4].

Despite its paternalistic intentions, the regime in the end simply had to come to terms with the fact of the violation and allowed the *alcaldes* to trade for a fee, the well-known *indulto de comercio* or *indulto para comerciar** [4]. The basic problem, of course, was that overweening political power allowed petty tyrants merely to manipulate flows of domestic trade that admittedly became increasingly profitable as specialisation increased and population grew.

Taking Barzel's point, however, it should cause no surprise that the rights ultimately went de facto to the *alcaldes* and were tolerated, if not recognised. What is remarkable is that the natives, who possessed this right in principle, derived so little benefit from the fact. Theories of contract, à la the Coase theorem, would predict that the interest of the rights-holder should have at least been bought out by those who could derive a greater benefit from its use. The fact that this did not happen must be traced to the overweening power of the state and the lack of restraints on the actions of the elite. The need for contract and compensation is suspended when seizure and predation serve just as well (a point we shall return to below). Indeed, the *alcaldes'* participation in trade often took the form of forcible and arbitrary confiscations, bolstered by the existence of numerous restrictions on the movements of goods and persons.

Again, from the viewpoint of supporting domestic trade, this was obviously an unsatisfactory approach, and economic theory would predict – as indeed happened – that this would lead to a contraction of commerce. Rizal [10] summed it up by noting how “the coastwise trade, so flourishing formerly, disappeared on account of the piracy of the Malaysians of the south, and trade in the interior of the Islands almost disappeared completely owing to the restrictions, passports, and other administrative requirements”.

Having considered the conditions of both foreign and domestic commerce, we contend, therefore, that no effective “demand” for impersonal rules invoking third-party enforcement could have emanated from the Filipinos (or the Chinese) early under the Spanish conquest. First the expanded trade across cultures and nations that would have made such impersonal rules necessary did not exist – indeed was suppressed –

* This “remarkable” innovation was in fact a typical response of the mercantile system, which would have been anxious to earn revenues that were more easily collected from the *alcaldes* than from dispersed peasants. North and Thomas [17] note how “the beneficiaries of a monopoly were easily identified, the private benefits measured, and the tax readily negotiated. Enforcement of the monopoly by the state was not difficult, since the monopolist could inform the authorities of violations and the collection of the tax was easy.”

and second, the subordinate position of the population would have made an appeal for state enforcement futile.

The other possibility, of course, was for a demand for impersonal institutions to have arisen from and among the Spanish colonists themselves, since they were after all the *de facto* possessors of rights. Why this did not occur to any significant degree may be attributed to the low colonial settler-density in the archipelago, a fact that has also been adverted to by writers such as Acemoglu et al. [18] in explaining differential development between colonies. Pursuing a similar argument for the Philippines, Cruz [19] finds that Spaniards barely reached one percent of the population of Filipinas. The great distance and hazards of travel from the Peninsula and Spain's absorption with its wealthier American possessions played a role not only in limiting the number of colonists but also in selecting them adversely for quality, causing a high rate of turnover, and fostering a get-rich-and-get-out-quick mentality. Together with the overall mercantilist policy that was hostile to trade to begin with, no clamour for impersonal institutions was likely to arise even from that quarter.

The "supply" of legal enforcement

The converse of the Filipinos' lack of an exchange-motive for demanding impersonal, state-enforced rules is the government's inability to commit to such rules. Greif [7] notes that:

[e]stablishing an exchange based on the law amounts to providing a public good, implying that this will happen only if the society can overcome the associated collective action problem. Furthermore, establishing an effective legal system requires institutions that will enable a state to *commit to not abusing property rights* [7]. (Emphasis supplied.)

In short, the frequent resort to legal enforcement systems in exchange is likely to arise only if the state can restrain its actions and effectively commit to protect property rights in an impartial manner. It is well known, however, that the Spanish regime from the beginning failed to protect the rights and entitlements of the natives even from depredations of its own officials. The absolute power of the government during the Spanish period made it an unreliable enforcer of impartial rules, with only weak, if any, controls on the actions of the elite. The checks and balances that the king of Spain hoped to institute in the government of the colonies failed miserably, owing in no small part to the distance from the mother country, the adverse selection among the settlers in Filipinas, and the relative insignificance of the country. Hence the natives' complaint recorded by Bowring (cited in Corpuz [3]): "The governor-general is in Manila (far away); the king is in Spain (farther still); and God is in heaven (farthest of all)."

Examples abound from the early years of the conquest of the Spanish regime's reliance on exactions rather than contract. The *tribute* was a compulsory head-tax

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imposed on all natives (initially either cash or kind, but later explicitly in cash). The *compra* on the other hand was an exaction in the guise of a sale, in which *encomenderos* stipulated quotas for produce to be bought at a price they themselves specified [4]. Commodities were accumulated for the purpose of supporting expeditions and provisioning galleon crews. The former practice essentially removed the certainty of ownership over output. The forced labour imposed in the *polos y servicios* (for clearing forests, constructing galleons, erecting churches, and rendering personal services to the fraterocracy, etc.) made the supply of own-labour unpredictable.

In *La indolencia*, Rizal recounts the earlier period of the conquest and cites the number of disincentives to work and trade:

Is it strange then that the inhabitants of the Philippines should be dispirited when in the face of so many calamities they could not tell if they would ever see sprout the seed they have planted, if their farms would be their graves, or if their crop would feed their executioner? What is strange when we see the pious but impotent friars of that time advise their poor parishioners, in order to free them from the tyranny of the *encomenderos*, to stop work in the mines, to abandon their industries, to destroy their looms, pointing to them heaven as their sole hope, preparing them for death as their only consolation? [10].

In another article entitled "Filipino farmers" [*Los agricultores filipinos*] for *La Solidaridad*, Rizal points to the primary disincentives to production on the part of Filipino capitalist-farmers (to which his own family belonged), which consisted of both natural causes of uncertainty and the uncertainty in property rights caused by the lack of peace and order, the rule of law, and arbitrary exactions by the elite:

The Filipino farmer has to struggle not only with plagues and public calamities, but also with petty tyrants and robbers. Against the first, defence indeed is permitted; against the latter, not always [10].

Sometimes, fortunately rare [sic] a *compañía volante* sweeps the province. Woe to those who have enemies! It is enough to be in the list of suspects for the head of the squad to pick him up and take him to another place without trial or filing of a complaint. Goodbye farm and goodbye everything! See if after this he will be encouraged to plant in other islands [10].

A further barrier to the emergence of exchange institutions was the insecurity of property in the land. To begin with, in the early *encomienda* economy, there was no landownership in principle, all lands belonging to the king's estate. Natives were simply assigned lots of equal size to cultivate, with usufruct rights. Again Corpuz [4]:

The families were *landholders*, not owners of the lands they worked. The lands could not be pledged as collateral for loans or mortgaged or sold to enable the families to engage in alternative occupations. Property rights in the *pueblo* lands remained in the king, so

that they were untaxed. For this reason the lands were untitled to the assignees. The lack of a titling requirement effectively erased the need for a land survey and cadastral system. The pueblo lands remained untitled and unsurveyed during the whole of the Spanish era.

The lack of property rights to their fields and the loss of much of the output from cultivation through various obligations dulled or extinguished incentives on the part of the tillers for greater efforts and improvements in pueblo agriculture. The mass of pueblo families had no overt savings, or stocks of produce for trading.

In short, even as suppressed exchange and the subordinate position of the *indios* weakened the exchange-motive for the demand for law and state enforcement, the supply of governance itself during the greater part of the Spanish occupation was not of the sort that would have encouraged it. In such circumstances it was to be expected that Filipinos would not generally gain confidence that formal institutions and legal enforcement mechanisms could serve as effective and unbiased means to resolve disputes and enforce contracts.

Conclusion

It is important to note how the suppression of trade with the rest of the world removed an important external factor for the Spanish regime to improve its legal system. As a result, the economy largely developed without too great a resort to the law as a support to exchange – indeed the law would more frequently prove a hindrance, either because its contents did not match the facts on the ground (e.g., prohibitions on trading, on land sales, and on lending and borrowing) or because they provided the pretext for often abusive and arbitrary behaviour on the part of officials, who did not have to contract for what they could simply exact.

Competing against the legal system, on the other hand, were the older and more tractable second-party enforcement mechanisms for exchange, based on repeated transactions, reputation, and frequently kinship, such as those the Chinese and the mestizos had long been accustomed to. With the scope of trade limited, these informal reputation mechanisms were beyond the pale of the law but accessible and suited the purpose for a level of exchange that was mostly local in scale and limited in scope to begin with.

Indeed, it is indicative that even by the time the country was opened up to world trade and British and American firms had become active, there had been no great change in the manner in which these merchants operated: they largely internalised or mimicked the pre-existing informal channels of buying goods, particularly in agriculture, relying on Chinese merchants who had their own informal buying networks, or employing their own provincial agents who acted largely in the same way.

By examining aspects of the formation of institutions affecting exchange, it has been our hope to contribute to that larger effort of understanding the evolution of the

more general attitudes of Filipinos with respect to state institutions in general. At least from this vantage, we find that during the Spanish period – which represents a large slice of history – neither the demand nor the supply could be found for the establishment of large-scale impersonal institutions that would facilitate commerce and the enforcement of contracts. The three crucial and interrelated variables in this institutional failure have been the degree of openness to trade, particularly to foreign trade; the degree of subordination of ordinary Filipinos in the colonial political system; and the lack of guarantees within the system against the untrammelled actions of the elite. The first two reduced the demand for such institutions; the last acted on the supply of credible commitment.

As a result, the majority of the people then came to regard government largely as an abstraction, if not an actual burden, vacillating between extravagant expectations of the idyll of the law writ on paper, on the one hand, and the reality of its fecklessness and exactions on the other.

At its best, government came to mean for the Filipino an institution that was burdensome; at its worst, it was predatory. At the same time, that it was incapable of promoting his welfare, it deprived him of his liberty, and was an ever-present threat to his security. To the Filipino, government became an institution to be avoided, for its interests were contradictory to his. People and government were estranged from each other, and the bonds of community were dissolved [3].

Corpuz's words, it is well to remind ourselves, pertain to a historical past, although it may just as well have been taken from yesterday's papers.

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PHILIPPINE AGRICULTURE IN A GLOBALIZING WORLD

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Abstract

The paper reviews the performance of Philippine agriculture in an Asian context. It shows that domestic policies and institutional bottlenecks, rather than global environment for agricultural trade, explain much of the country's comparatively weak performance in food production, employment creation, agricultural trade, and poverty reduction. Poor governance has also weakened the sector's capacity to respond efficiently to urbanization influences, especially changes in consumption patterns and land use owing to the combined impact of population growth, rising incomes, and developments in information and technology. The "business as usual" approach to governing agriculture and the rural sector needs to be abandoned in favor of more aggressive governance reforms and strategic investment aimed at raising agricultural productivity and sustaining gains in farm incomes, reducing the "cost of doing business" in rural areas, and taking advantage of opportunities for growth offered by globalization.

Keywords: Philippine agriculture, globalization, urbanization, domestic policies

Introduction

Production growth in Philippine agriculture during the first four years of this decade averaged 3.9% a year. This growth is quite respectable by the standards of the previous two decades and of the major developing Asian countries. The growth for the first quarter of 2004 is even more impressive: 7.7% compared with 3.3% for the first

quarter of 2003. Does this performance reflect a structural departure from the low-growth path that characterized the sector in the 1980s and 1990s? Put differently, is this growth sustainable?

The issue of sustainability is paramount partly because the agriculture sector contributes substantially to national income, employment, and poverty. The sector's output accounts for about a fifth of the Gross Domestic Product, while the total number of people engaged directly in agriculture is over one-third of total employment. The sector's high share in employment, combined with its relatively low share in national income, suggests though that labor productivity in agriculture is low compared with the rest of the economy. Not surprisingly, the large majority—61%—of the poor come from this sector [1]. Even poverty in urban areas is partly an indirect effect of poverty in agriculture, i.e., extreme deprivation or lack of livelihood opportunities in rural areas induces rural-urban migration.

The low productivity in agriculture, combined with a trade policy regime that effectively inhibits importation of food products, translates to high food prices, which, in turn, reduce the purchasing power of household incomes, hurting especially the poor, including the large majority of small farmers who are net buyers of food. High food prices also put upward pressure on wages (since food is a "wage good"), thereby eroding the competitiveness of the country's domestic producers vis-à-vis foreign producers. In successful cases of rural development, wages rise as a result not of high food prices but of rising labor productivity and increasing labor scarcity induced by sustained expansion of employment opportunities in the economy.

The concentration of poverty in this sector suggests that an effective poverty-reduction strategy has to involve sustained efforts to raise agricultural productivity and farm incomes, tame increases in food prices, and create employment opportunities for the rural population. Indeed, recent Asian development experiences demonstrate that agricultural development fuelled primarily by productivity growth is key to sustained growth and poverty reduction.

The challenge is to identify key drivers of sustained agricultural growth, especially policy responses to the twin forces of globalization and agricultural trade liberalization. By globalization, we mean the growing integration of economies through the flow between countries of goods, services, capital, people, information, and ideas. Not a few, including government officials, contend that these twin forces are a bane—not a boon—to the agriculture sector and the poor. The popular call is to protect the sector from import competition through a reinstitution of trade barriers, especially for so-called "sensitive products." Indeed, the domestic policy response has included active participation in trade coalitions whose main objective is to secure protection for these sensitive products (in the Philippine case, these are rice, corn, sugar, and meat), while demanding removal of all forms of trade restrictions, domestic support, and subsidies of developed countries to their agriculture sector.

But as the saying goes, there is no such thing as a free lunch. The policy posture of protecting agriculture through import-limiting restrictions results in higher domestic food prices. As shown below, food prices are notably high in the Philippines compared with the country's major competitors in the Asian region. High food prices are a recipe for hunger and food insecurity, especially for the rural population whose access to infrastructure, technology, and credit is very limited. Perhaps not surprisingly, malnutrition and hunger indicators are persistently high in the Philippines compared with Asian countries of similar income levels.

This paper attempts to identify key drivers of sustained agricultural growth and rural poverty reduction in the context of a globalizing world. The first section provides an overview of globalization and trade liberalization in relation to agricultural and poverty outcomes in developing countries. The second section then examines the performance of the Philippine agriculture sector from an Asian perspective, specifically focusing on the nature and consequences of the "rice problem." The third section moves on to discuss key drivers of agricultural growth in a globalizing and liberalizing world. The fourth section gives the concluding remarks.

Globalization and Trade Liberalization: A Bane or a Boon?

Sustained agricultural growth, especially pro-poor growth, does not come out of a vacuum. Domestic policies and institutions play a significant role. And so do the global trading regime for agriculture and the external forces associated with globalization. Indeed, as noted earlier, not a few contend that the twin forces of globalization and agricultural trade liberalization are a bane – not a boon – to the poor in the Philippines. The main argument, put simply, is that the country has neither the broad infrastructure (physical and human capital) nor the institutions (good governance) to effectively gain from the benefits that globalization and trade liberalization offer. Even more fundamental, however, is the additional argument that, in practice, "free trade" in agriculture is not "fair trade" since the developed countries continue to provide enormous subsidies to their farmers (thereby limiting the access of developing countries to their domestic markets), while the developing countries, including the Philippines, have taken great strides in fulfilling their part of the bargain (i.e., opening up their domestic markets).

From an empirical perspective, is it the case of globalization and trade liberalization tending to systematically hurt the prospect for food security and agricultural development in developing countries, including the Philippines? In what ways do these erode—or enhance—the welfare of the poor? What should the policy responses to globalization be? What institutional arrangements can be pursued at the national and regional levels to enhance the chances of developing countries to benefit from—and not be doomed by—globalization and multilateral liberalization? These issues are admittedly complex and not impervious to impassionate discussions.

Globalization and poverty

Globalization is not a new economic phenomenon. It has come in waves during the past 150 years. The first wave, which occurred in the 1860–1910 period, was interrupted with the re-imposition of trade, capital, and migration controls that followed the First World War and the Great Depression. The second wave, from 1950 to 1980, witnessed the unprecedented integration among the developed countries, while most developing countries chose to restrict their involvement in foreign trade and investment. The third wave, which began in the late 1970s and continues to this time, has seen the unprecedented participation of large developing countries – China, India, Mexico, Indonesia, and Vietnam among them – in foreign trade and investment.

The driving forces toward globalization have been the advances in transport, communication, and information technologies. Key innovations in transportation have significantly reduced the cost of doing business in terms of time and money [2]. Between 1930 and 1990, the real cost of ocean freight transport fell by 54%, while that of air transportation declined by 84%.

The past 45 years have also seen significant developments in telecommunication and computing. Rapid technological advances have led the real price of computers and peripheral equipment to fall by more than 100% between 1960 and 2000 [2]. At the same time, improvements in their computing and processing capabilities have resulted in innovations in the different stages of the production process, which have translated to further cost savings. The past 15 years have also seen the exponential growth of the newest form of communication, the Internet, which has made communication dramatically faster and cheaper. Cheaper, faster, and more reliable telecommunication and information technologies have reduced the effective distance between markets, successfully inducing rapid developments in financial intermediation and international trade in goods, services, and ideas.

The popular view about contemporary globalization is that it has led to increases in inequality and poverty in developing (as well as developed) countries. The weight of evidence, however, does not support this view. There is simply no systematic relationship between any measures of globalization and household inequality and poverty [3, 4, 5]. Some countries that opened up did experience increases in inequality; others did not. What is evident is that developing countries whose economy grew comparatively fast as they opened up did witness substantial decline in absolute poverty. Between 1993 and 1998, the number of absolute poor in globalizing developing countries declined by 120 million, while poverty increased by 20 million in the rest of the developing world. Poverty reduction in China and Vietnam, in particular, is unprecedented in history. The reduction is also strong in India (since the late 1980s) and other globalizers in the region. While the Asian financial crisis reduced incomes in the two worst hit countries, namely Indonesia and Thailand, the gains in poverty

reduction during the past-quarter century of growth and trade liberalization have largely remained intact.

To be sure, globalization does redistribute income among groups. There are winners and losers, both among the rich and among the poor. There are risks, too, as demonstrated by the Asian financial crisis. The crisis resulted in currency devaluation and higher food prices, which proved to be very disruptive to the poor. There is a lot to be said on the role of governance to ensure that the risks associated with globalization are mitigated, if not altogether avoided. Globalization, for example, will result in job displacement, even in agriculture.

WTO agriculture negotiations

Globalization and the World Trade Organization (WTO) Agriculture Negotiations, though quite distinct developments, are intertwined. As noted above, globalization pertains to the increasing integration of economies and societies through the flow of goods, services, technologies, finance, and information. The Uruguay Round/WTO Agriculture Agreement's overall purpose is to correct and prevent restrictions and distortions in world agricultural markets.

The Uruguay Round Agreement provided a framework of rules and started reductions in protection and trade-distorting support, including agriculture. The current Agreement ends in 2004, but Article 20 of the Agriculture Agreement committed members to start negotiations on continuing the reform beginning in early 2000. In the initial phases of the negotiations, the main issues were substantial reductions in tariffs, domestic support, and export subsidies, although other issues also acquired prominence. Some countries raised non-trade concerns as an important area for negotiations, while others (including the Philippines) insisted that special and differential treatment for developing countries should be an integral element of agriculture negotiations.

The November 2001 Doha Ministerial Declaration builds on the work already undertaken in the agriculture negotiations, reconfirms and elaborates the objectives, and sets timelines for the negotiations. In this declaration, agriculture becomes part of the single undertaking in which virtually all the linked transactions are to end by January 2005. As in Article 20 of the Agriculture Agreement, the Declaration affirms that the main objective is to establish a fair and market-oriented trading system through a program of fundamental reforms. The program encompasses strengthened "rules of the game" and government commitments to substantially reduce trade-restricting distortions, prominent of which are market access restrictions, export subsidies, and domestic support.

The Declaration makes special and differential (S&D) treatment for developing countries an integral part of the WTO negotiations, emphasizing that all S&D provisions should be effective in enabling developing countries to meet their needs, in particular, food security and rural development. It also confirms that non-trade

concerns – environmental protection, biodiversity, food safety, animal health, etc. – reflected in the negotiating proposals already submitted are to form part of the negotiations. Moreover, it recognizes the prerogative of a member country to take measures for the protection of human, animal or plant life, or of the environment at levels it considers appropriate, provided that these do not constitute arbitrary or unjustifiable discrimination between countries, or a disguised restriction on international trade.

The wide range of views and interests among member governments makes the negotiations difficult. Setting this difficulty aside, the benefits of open and non-discriminatory multilateral trading systems are enormous. This is particularly the case for many developing countries whose economies depend on an increasingly diverse range of primary and processed agricultural products that are exported to an increasing variety of markets. Moreover, freer trade regimes and better government focus on support services would allow for a more efficient resource allocation among and within sectors of these economies, thereby providing an enduring foundation for sustained rural growth, food security, and poverty reduction.

In practice, realized benefits have been much less than expected. While developing countries endeavored to meet the targets agreed upon under the WTO Agriculture Agreement, many developed countries reneged on commitments made in the Uruguay Round. Nominal protection on agriculture in OECD countries has remained high – in fact, it has increased in the second half of the 1990s and at the turn of the new century.¹ Domestic support and export subsidies continue to be historically high in a number of these countries. Moreover, many developed countries—and, to some extent, also developing countries—have increasingly employed non-tariff barriers, particularly sanitary and phytosanitary measures, as well as anti-dumping measures, more to protect domestic interests rather than to address genuine human health or industry-injury concerns.

Given the aforementioned problems, it is tempting to suggest that the Philippines should withdraw from any future agriculture negotiations, or that it should put back trade measures aimed at restricting entry of foreign goods competing with locally produced goods. Ironically, it would be a terrible mistake if the country does. Neither would it be in the country's best interest – at least from an efficiency ground – to link its reforms with the domestic policy stance of developed countries. In the same vein, its undue focus on global coalition-building deflects much-needed attention from what essentially are domestic concerns. As will be explained below, from the viewpoint of sustained poverty reduction and food security, these options are inferior to a trade regime of openness, no matter how imperfect the multilateral trading system is at the moment.

¹ Nominal rates of agricultural protection in OECD countries rose from 45% in 1986 to roughly 70% at the turn of the century.

Philippine Agricultural Growth and Poverty in an Asian Perspective

Prior to the country's accession to the WTO in 1995, the performance of the agriculture sector was quite pathetic compared with those in other Asian countries. During the period 1980-94, Philippine agriculture grew at a measly 1.5% a year, the lowest among the major developing Asian countries (Table 1). The growth was even less than the rate of population growth (averaging about 2.4% a year). The mediocre growth mirrored the poor performance of the overall economy.

In the period following the country's accession to the WTO, the country's agricultural growth improved to 2.4% a year, though this was still pale in comparison with the averages for China (3.5%) and Vietnam (4.2%), two of the most aggressive globalizers in the Asian region. The figure is surprisingly higher than the averages for Malaysia and Indonesia and comparable with Thailand's. Note, however, that in both Malaysia and Thailand, the relative importance of agriculture in national income had declined substantially during the past two decades of rapid economic growth, while in Indonesia, the Asian financial crisis of 1997-98 left a deep puncture on the economy and the agriculture sector.

Table 1. Average agriculture growth rates (% per year), 1965-2002

	1980 - 1994 Pre-WTO Accession	1995 - 2002 Post-WTO Accession
Malaysia	2.44	0.64
Sri Lanka	2.71	1.19
Indonesia	3.51	1.74
India	4.12	1.75
Philippines	1.49	2.40
Thailand	2.87	2.78
Nepal	3.36	2.94
Bangladesh	2.29	3.41
China	5.16	3.50
Pakistan	4.12	3.52
Vietnam	3.24	4.25

Note: Data for Malaysia starts only in 1971; Nepal in 1966; Vietnam in 1986

Source: World Bank [6].

Viewed from a historical perspective, the growth rate posted in 1995-2002 was still way below what was achieved during the height of the "green revolution" period (1965-1980) when it averaged 4.1% a year. Indeed, during this period, the Philippines was a

star performer in the agricultural growth race in the Asian region. The period was marked by the diffusion of modern rice technology and substantial public investment in irrigation and other rural infrastructure. The rice sector was a driving force in Philippine agriculture, accounting for nearly one-fifth of total agricultural output.

What Table 1 suggests is that, contrary to popular claims, especially by many nongovernmental organizations (NGOs) and influence peddlers in government, the country's accession to the WTO could not be a compelling reason for the comparatively poor performance of agriculture in recent years. All the other major developing countries in the Asian region operated in a similar global trading environment as that of the Philippines but had significantly higher agriculture and overall economic growth rates than that achieved by the Philippines.

Production growth could come from either expansion of the cultivated area or from increases in output per unit area. The former is no longer a practical option for the Philippines. Hence, output growth would have to come from productivity growth through sustained technological improvements.

A comprehensive measure of productivity growth is total factor productivity (TFP) growth. This measure represents output growth net of the growth in all production inputs. It is thus an appropriate indicator of efficiency (and competitiveness) improvement. The available TFP data for the 1970s suggest that the Philippines at that time fared comparably with Thailand and Indonesia (Table 2). However, the succeeding two decades saw productivity stagnating in the Philippines (0.2% a year), while it continued to grow in Thailand (1.0% a year) and Indonesia (1.5% a year). China, on the other hand, enjoyed a very high TFP growth rate of 4.7% per year during this period, though the figures pertain to grains only. At this rate, it is not surprising that China increasingly has become a major producer of cheap agricultural commodities in the world commodity markets. Also, at this rate, China could well afford to reduce tariff protection for its farmers even before it acceded to the WTO without reducing farmers' net incomes [7].

Table 2. Growth of total factor productivity (TFP) in agriculture (% per year)

Period	China	Thailand	Indonesia	Philippines
1970-1980	Na	1.3	1.6	1.0
1980-2000 ¹	4.7	1.0	1.5	0.1
All Period		1.2	1.5	0.2

¹1979-95 for China (covering rice, wheat, and corn only), 1981-95 for Thailand, 1981-98 for Indonesia, and 1980-98 for the Philippines.

Source: Mundlak et al. [8] for Indonesia, Thailand, and Philippines; Jin et al. [9] for China.

As noted earlier, the low productivity growth in agriculture, where the bulk of the poor are located and in which they depend on for incomes and livelihood, mirrors what would be expected on the evolution of farm incomes, household incomes in general, and poverty. As recent experiences in Asia and elsewhere suggest, productivity growth in agriculture exerts strong direct and indirect influence on poverty and food insecurity [5, 10, 11, 12]. It is thus not surprising that the progress in reducing hunger incidence and malnutrition has been quite miserably slow in the Philippines compared with virtually all the developing countries in Asia (Table 3).

Table 3. Proportion of people who suffer from hunger

Country	Percentage of children under 5 years of age who are moderately and severely underweight		Proportion of the population below minimum level of dietary energy consumption	
	Early 1990s	Late 1990s- Early 2000s	Early 1990s	Late 1990s- Early 2000s
Cambodia	40	45	43	36
China	16	10	16	9
Indonesia	35	26	9	6
Lao PDR	44	40	29	24
Malaysia	23	18	3	-
Philippines	30	28	26	23
Thailand	26	19	28	18
Vietnam	45	33	27	18
Bangladesh	67	48	35	35
India	53	47	25	24
Nepal	49	48	19	19
Pakistan	38	38	25	19
Sri Lanka	38	29	29	23

Source: ESCAP [13], Figure 1.3.

The rice problem

The rice sub-sector is a microcosm of Philippine agriculture. Accounting for about 20% of agriculture's gross value added, it is the single most important source of livelihood among small farmers and landless agricultural workers who make up the bulk of the agricultural labor force (which, in turn, represents 40% of the labor force nationwide). It is thus not surprising that the growth trend in rice production roughly mirrors that in agriculture.

After averaging 2% a year in the 1980s, rice production picked up in the 1990s, growing at an annual average rate of about 2.8%. This performance was attributable to the rising real domestic rice price (despite falling world price) and falling real input prices, except wages. The onslaught of the El Niño phenomenon in 1998 caused rice production to fall sharply by 24.2%. However, an equally sharp rebound took place in the following year when output rose by 37.8%, thereby permitting a positive production growth for the decade.

Despite growth in recent years, the Philippine rice sector still performed poorly compared with other countries in Asia. Yield (output per hectare of land) is a crude indicator of productivity, but it usually is a reasonably sufficient comparative device. Under this measure, average rice yield in the Philippines ranked lowest at 3.2 t/ha among the country's neighbors from 2000 to 2002 (Table 4). The figure is even lower than the average for East and Southeast Asia combined and the average for all developing countries at 3.7 and 3.9 t/ha, respectively.

The same story can be gleaned from the yield of corn, the country's second most important crop in terms of its contribution to total agricultural output and area. The country's average corn yield of roughly 2.0 t/ha is the lowest in Asia, only two-thirds that of the average for all developing countries, and only one-half that of China. The Arroyo administration has paid much less attention to the development needs of this sector.

The rice policy framework of the government is to intervene heavily in the rice sector to achieve the twin objectives of stable and high prices for farmers and of stable and low prices for consumers. It has employed a variety of instruments—output procurement, credit subsidies, tariffs and quantitative trade restrictions, provision of rice subsidy to consumers, and public spending in research, irrigation, extension, land reform, other support services—to effect these objectives.

Table 4. Rice and corn yield, average of 2000-02 (t/ha)

	Rice	Corn
East & South East Asia	3.7	2.6
Developing Countries	3.9	3.0
Philippines	3.2	1.8
Myanmar	3.5	2.0
Vietnam	4.4	2.8
Indonesia	4.4	2.8
China	6.2	4.8

Source: FAO Database [14]

Of these interventions, perhaps the most controversial ones have to do with the operations of the National Food Authority (NFA), the government's price and supply stabilization arm in the rice sector. NFA has (until lately) the virtual monopoly over international trade of rice, the discretion to issue import licenses, and the mandate to operate the marketing and price support operations of rice and corn. Its interventions have been justified on the grounds that the world rice price is highly volatile and that private traders extract monopoly profits from farmers during harvest season and from consumers when rice is scarce. Various studies, notably by David [15], Roumasset [16], and Balisacan et al. [17], have shown that these interventions have in fact exacerbated market failures, increased the volatility of domestic prices, reduced the welfare of both consumers and producers, discouraged the private sector from investing in efficiency-enhancing distribution and storage facilities, and bred corruption and institutional sclerosis.

Rather than gaining from NFA operations, taxpayers have in fact been in the losing end. Roumasset [16] estimated the total costs of price controls on rice in 1999 to the tune of P49 billion: P3.7 billion from foregone tariff revenues, P18.5 billion from foregone consumer tax revenue, P7.9 billion from foregone producer tax revenue, P6.4 billion from excess burden to consumers, and P3.3 billion from excess burden to producers. In 1998, the financial subsidies to NFA amounted to over P6.3 billion. This amount was far more than the amount (less than P1 billion) provided to agricultural research and development in rice, which arguably yield far higher social rates of return. In recent years, the cost to the government and taxpayers of a P1 income transfer to the poor through the NFA's general price subsidy scheme is from P3 to P6 [18].

Notwithstanding the enormous resources spent on NFA operations, domestic rice prices are far higher in the Philippines than in other developing Asian countries, especially since the mid-1990s (Figure 1). In the late 1990s, following the ascension of the country to the WTO, domestic prices soared, rising 86% and 40% higher than in Thailand and Indonesia, respectively. In the same year (1996), the Philippine nominal wholesale price was almost twice (91%) as much as the world price. Given that rice is the country's main staple, especially among the low-income groups, this high-rice-price policy hurt the poor and contributed to the high incidence of malnutrition in the country. Clearly, there is a need to reexamine this policy posture.

In 1996, in conformity with the country's accession to the WTO, the Philippine Congress passed Republic Act 8178, which lifted all quantitative import restrictions in agriculture except rice. In lieu of these restrictions, their tariff equivalents were put in place. But because finding the tariff equivalent of a quantitative restriction (QR) is not a simple exercise, the process led to "dirty tariffification." Nearly all the commodities were given tariff rates of 100 percent, even though the nominal protection rates of these commodities, based on strict comparison of domestic price and world price, were much lower [15]. In other words, the tariffs given were much more than the tariff equivalents

of the protection regime existing before the accession to the WTO. At the end of the 1990s, the overall tariff protection for agriculture (13.3%) was higher than that for industry.

For rice, the tariff equivalent of its present QR from 1995 to 2002 is 67.2%. Clearly, this commodity has been highly protected in recent years. As noted earlier, this protection has been justified by the need to shield the incomes of small farmers from erosion caused by competitive imports. However, this stance fails to address the root causes of the farmers' incapacity to ably compete with imports, foremost of which is the government's failure to secure a healthy investment climate and provide the required public support services necessary to increase productivity.

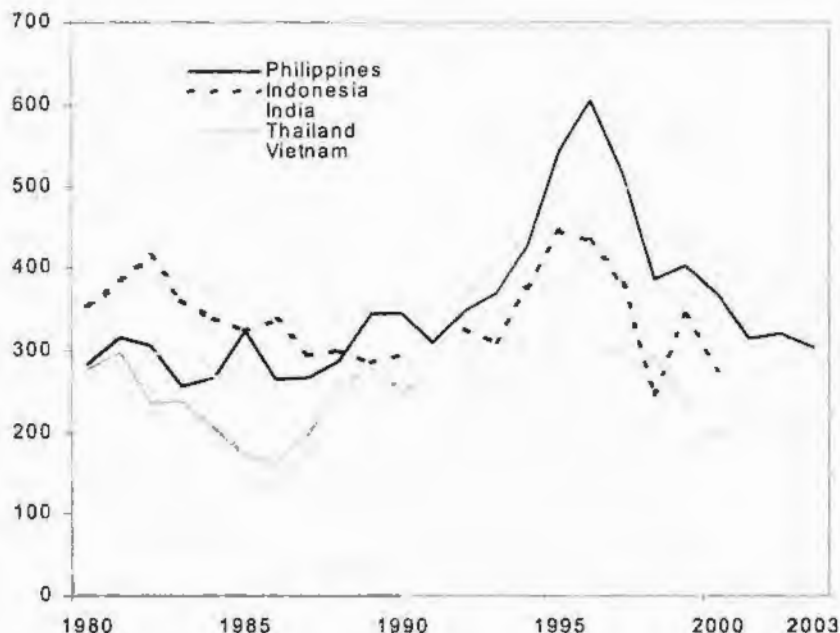


Figure 1. Wholesale price of rice, US\$/mt

Sources: IRRI; BAS; Bank of Thailand; Nielsen 2003; Ministry of Agriculture Government of India

"Business as usual" vs. "strong reform" agenda

To further examine the rice and agriculture problem, an enhanced multi-market simulation model of Philippine agriculture, the Agricultural Policy Simulation Model (APSM), was used to generate probable outcomes to a variety of "what if" questions.² Two cases are shown here: a base scenario or the "business-as-usual" agenda and a "strong reform" agenda. In the base case, QRs equivalent to 50 percent tariff rates are maintained for the major sub-sectors of agriculture (rice included), while public investments in the sector continue at a slow pace, as in the 1980s and 1990s. This simulation roughly corresponds to the status quo. The strong-reform agenda, on the other hand, is characterized by gradual liberalization of agricultural trade – removal of QRs and reduction of tariffs over a five-year period – complemented by increased public investment in support services, particularly irrigation, R&D, and extension. This roughly corresponds to China's "reform path" for agriculture and rural development (see, e.g., Huang et al. [7]). Some results are summarized in Table 5.

The business-as-usual simulation results suggest that yield growth rates in the medium term are low by historical and international standards. Imports of the country's major staples – rice and corn – rise significantly during the period. Poverty reduction is slow, especially in rural areas. Furthermore, the low growth of incomes in rural areas compared with urban areas induces substantial rural-to-urban migration, thereby accentuating population-related urban problems.

On the other hand, the "strong reform agenda" scenario suggests reduced domestic agricultural prices arising from the reduction in tariffs and removal of QRs. Farm household incomes rise despite the fall in farm prices owing to increases in agricultural productivity brought about by a more aggressive public investment in irrigation, R&D, and information generation and diffusion. Furthermore, the impact on poverty is high in the medium term; poverty incidence in this scenario is lower, on the average, by 10 percentage points than in the base case.

Clearly, in the Philippine case, the business-as-usual approach to governing agriculture and the rural sector needs to be abandoned in favor of more aggressive reforms and investments aimed at raising agricultural productivity and sustaining gains in farm incomes, reducing the "cost of doing business" in rural areas, and taking advantage of opportunities for growth offered by globalization. This should also be coupled with ensured accountability, improved coordination, and program focus among agriculture-related agencies of the government. This is an important area where the NGOs, local governments and civil society should come in. They must play an active role in planning, implementing, and monitoring agricultural and rural development programs. This would foster accountability and sustainability in the system.

² For a discussion of the model, see Asia-Pacific Policy Center, *Pathways to Sustained Poverty Alleviation: Agrarian Reform Communities and the New Economic Paradigm* (report submitted to the Food and Agriculture Organization, April 2002) [19].

Key Drivers of Agricultural Development in a Globalizing World

As noted above, agricultural growth and rural development is key to poverty reduction and food security. However, this does not take place in a vacuum. An effective strategy to achieve it is one that is comprehensive, encompassing the entire stretch of the supply chain, while keeping focused on strategic areas where potential economic returns on investment (time and money) are high and broadly based. With respect to production inputs, the issues of availability and quality, accessibility and affordability, especially by small farmers, need to be addressed. Meanwhile, the solution may require policy changes, prioritization of public expenditure programs, and the establishment or strengthening of national and local institutions.

Access to modern science and technology

There have been tremendous advances in agricultural science and technology, which, if fully harnessed, could accelerate the growth of the agriculture sector.

The profile of agricultural inputs has been changing and, in general, the "quality" has been deteriorating – smaller farm sizes, degraded lands, extreme weather conditions, and incidence of new types of pests and diseases. These factors notwithstanding, some countries have managed to increase significantly their agricultural output through technological improvements. In Thailand and China, the key factor has been the widespread use of modern plant varieties that are high-yielding and resistant to biotic stresses. Their experience suggests that farmers are generally risk-neutral and receptive to new technology, although also concerned about affordability and profitability.

On the other hand, consumer demand for food (i.e., food type and quality) is largely driven by income. Different countries demand different types of food and high-income consumers are willing to pay a premium for quality. The R&D and extension program must be able to respond to these demands. It must be able to inform producers on the proper technology of producing different food items of a certain quality. Furthermore, post-production technologies designed to prolong the shelf life of food should be given high priority in the program.

However, financially viable and location-specific technologies take time and resources to develop. Governments, as well as the private sector, need to invest in their development and diffusion. The Philippines has been underinvesting in R&D over the past 20 years. The country's public expenditure on agricultural R&D averages only 0.3% of GDP, way below those of Malaysia (1.1%) and Thailand (1.6%). The norm for developed countries, in contrast, is about 3% of GDP (e.g., Taiwan's average is 3.4%).

Alston et al. [20] report very high internal rates of return for agricultural R&D in Asia-Pacific, averaging 49.5%. The same order of magnitude has also been found for the Philippines (see Intal [21]). It is not surprising then that the private sector has

assumed a more active role in this area such as in Thailand. In such cases, the government's role would be to direct R&D efforts with consideration for the needs of small farmers, and, if necessary, take on the slack. In other countries, the role of government is to create a policy environment that is conducive to private R&D. In the case of biotechnology, for instance, the government may have to broker dialogues between opposing parties or support studies that objectively evaluate the issues.

A technology-driven growth in agriculture is possible only when the rural populace has the tools and skills necessary for modernization. Furthermore, investment in education has reinforcing effects on poverty through health, nutrition, reduced fertility rates, and higher productivity.

Extension systems, if of good quality, provide avenues for human development and generate externalities to the entire sector. These twin objectives are achieved through the dissemination of new technologies coming out of the research system and the feeding back of problems actually faced by farmers to the research systems. Demonstration farms, for example, have been used to integrate research and extension processes. Recently, the trend elsewhere (e.g., India) has been toward setting up of ICT-based on-farm research that essentially completes the cycle of research-extension-feedback-research.

Access to land

More often than not, labor is the poor's only asset and, for the most part, they could offer unskilled labor only. Providing them access to land will enable them to have command over another major factor of production. Note, though, that they will need to be given secure property rights over the land. Insecure tenure creates uncertainties and leads to sub-optimal outcomes both for short-term agricultural output and sustainable development. For instance, it would not be rational to plant perennial crops nor invest in land development if the farmer is not secure over his tenure of the land.

Secure land rights likewise offer opportunity for smoothing consumption in the event of adverse income shocks, such as when one is hit by a sudden unemployment spell or by a natural calamity. Land is an attractive collateral, thereby affording its owner access to formal financial intermediation. Studies on the Comprehensive Agrarian Reform Program (CARP) show that, as a whole, the land transfer program has effectively increased the beneficiaries' farm productivity, real incomes, and rates of physical asset accumulation by more than those realized by non-beneficiaries [1, 22]. Moreover, children of land reform beneficiaries have accumulated human capital faster than those of non-beneficiaries. The progress in poverty reduction is likewise notably faster in agrarian reform communities (ARCs) than in comparable non-ARCs [23, 24].

These achievements have, however, come at a high price. The unduly long CARP implementation has eroded confidence and certainty in rural land markets, thereby inhibiting much-needed private investments. Hence, the program's implementation needs to be accelerated. At the same time, all possible avenues for achieving the equity

goal of CARP have to be pursued with greater vigor and political resolve. Toward this end, it is imperative to expand the scope for community-managed land reform, as well as other institutional arrangements that have proven effective in reducing poverty in agrarian communities (e.g., joint ventures).

Access to rural infrastructure

Oftentimes, the quality of extension service is hampered by the poor state of rural infrastructure. In addition, deficient farm-to-market roads prevent producers from bringing their raw agricultural produce to markets in urban areas where their products could command higher prices. Too often, this explains the large gap between farm gate and market prices. Furthermore, high transport and communication costs weaken the employment-creating linkages between agriculture and the rest of the economy. With high transaction cost, the potentially strong response of poverty to agriculture growth and urban demand growth is muted.

Increased public investment in rural infrastructure will have to be accompanied, therefore, by reforms that will effectively liberalize land transport, inter-island shipping, port cargo handling, and telecommunication. These policy reforms will bring down the production and marketing costs in all sectors. At the same time, increased private sector participation in road building and maintenance of upland areas should be encouraged.

Irrigation development

Agriculture is highly dependent on moisture. Unfortunately, natural sources are unpredictable, at best, and very scarce, at worst. Consequently, farm incomes are very uncertain at best, and very small at worst. Irrigation development, apart from technology, is key to resolving the situation. Hence, it can be a major source of growth in the agriculture sector. However, it is imperative that constraints to irrigation development be immediately identified and properly addressed. David [25] describes the poor state of irrigation development in the country. Less than 30% of potential irrigable land is served by an irrigation system. Worse, the present systems are very inefficient and in urgent need of repair and rehabilitation.

Irrigation development should focus on small-scale, farmer-operated irrigation systems (e.g., shallow tubewells). These are far cheaper (on a per-hectare basis), more sustainable, and more favorable for crop diversification, than the large systems operated by the National Irrigation Administration (NIA). The cost per hectare to develop small-scale, farmer-operated systems is just about one-third of that for large NIA systems. The current NIA practice of irrigation development binds farmers to rice farming, rather than expanding farmers' options to move to more profitable crops or farming systems. This practice effectively closes a very important avenue for long-term poverty reduction in rural areas.

Incentive structure and governance

Contrary to popular belief, farmers, even traditional farmers, do respond to economic incentives, especially price incentives. For instance, China in the mid-1980s exhibited dramatic growth in agricultural output mainly due to the institutionalization of the household responsibility system in place of the old system, where output in excess of state-determined quota reverts to the state and not to the producers themselves.

Government must concentrate on creating a macroeconomic environment that encourages investment. For instance, maintaining a reasonably healthy public finance reduces private investment risk. On the other hand, an exchange rate policy that results in an overvalued home currency penalizes the tradable sector, wherein the agriculture sector is a prominent player.

There is also a lot to be said about governance. If the rules are not transparent, and worse, if they lend themselves to subjective judgment, then there are ample opportunities for rent-seeking activities. Apart from distorting the demand and supply situation and discouraging above-board trading activities, these raises the "cost of doing business" in the country.

A very critical problem in agriculture-related government agencies—and, to be sure, virtually in all other public agencies, including both houses of Congress—is that there is no system in place that allows one to check whether the billions of pesos being spent for agriculture and rural development programs are in fact actually benefiting the small farmers and fishers. Putting in place an impact monitoring system need not be expensive if appropriate statistical practices are employed. It is best that the monitors be independent of those who design and/or implement government programs. There are many credible research organizations around the country, including state universities and colleges (SUCs), that could be tapped to perform this task.

Well-targeted safety net program

While globalization is expected to be beneficial on the whole, it may also have adverse effects on particular sectors. Resources will tend to be allocated to the more efficient industries and away from sectors where the home country does not have a comparative advantage. In order to address the needs of these sectors, government must implement a well-targeted safety net program, thereby containing political unrest. The objective is to provide short-term assistance and facilitate the re-tooling of the affected sectors. The program should, however, be designed carefully, ensuring that it is incentive-compatible, i.e., unintended beneficiaries do not find it worth their while to preempt the program benefits, while the intended beneficiaries do.

Concluding Remarks

The recent resurgence of agricultural growth is not a call for comfort. The problems ailing Philippine agriculture are far more serious and urgent than recognized

so far by the national leadership and body politic. The roots of these problems have to do with the country's failure to secure sources of productivity growth and income diversification in the rural economy.

Both domestic policies and institutions have constrained efficiency and raised the "cost of doing business," thereby blunting productivity growth and eroding the country's competitiveness in the global marketplace. Rice, the population's staple food, has become more expensive in the Philippines than in other developing East Asian countries, owing principally to the government's ill-advised self-sufficiency objective. Liberalizing rice trade enhances the welfare of the poor, especially the landless workers and urban consumers, although the short-term cost to the rice sector in terms of reduced incomes and labor displacement may be quite substantial. However, when this is combined with public investment in productivity-enhancing support services (particularly R&D and irrigation), rice trade liberalization is a win-win proposition.

In addressing the pressing issues of today vis-à-vis poverty and food insecurity, it is important not to lose sight of the key lessons on agricultural growth and development in Asia in the past half-century. One such powerful lesson has to do with enabling the rural poor through policy, investment, and institutional reforms that enhance the efficiency of domestic markets and provide improved access to technology, infrastructure, and education. This enabling environment allows rural growth benefits to be broadly based, thereby enhancing overall nutrition, human capital development, and productivity and economic growth in the medium- to long-term. Almost invariably, the successful cases of rural development and poverty reduction have shown tenacity in the pursuit of efficiency-enhancing reforms. The key driver to these reforms has been neither globalization nor agricultural policy in developed countries. Rather, it is—by and large—the internal realization that reforms are for the benefit of the country and its citizens.

Globalization has its downside risks, but it also offers potentially enormous benefits. Many developing-country globalizers have shown that those benefits more than outweigh the costs: the speed of poverty reduction is, for example, unprecedented in China, Vietnam, and India. The challenge for the Philippines is to find the appropriate mix of policies and institutions needed to exploit the benefits, while being on guard for the downside risks. Fortunately, for agriculture and the rural sector, the aforementioned key policy and governance reforms required to enhance efficiency (raise productivity and income) are largely compatible with globalization as well.

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SCIENCE CULTURE AND EDUCATION FOR CHANGE Part I: Innovative Strategies for Secondary Education in the Philippines.

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Abstract

The current situation of Philippine education presents problems and challenges of staggering proportions. With old paradigms deemed insufficient, we present investigations of new structures that could boost effectiveness of the Philippine educational system. These apply the key observation that, Money is not the problem. Culture is the problem. In particular, we address the questions: What programs can foster the highest levels of learning, creativity, and productivity while overcoming severe constraints of poverty, low standards of living, substandard learning conditions, and formidable cultural barriers? What programs can generate higher levels of human development for a country by the cultivation of a healthy, cultured, and socially responsible citizenship?

We present an innovative, differentiated, and target-oriented program for high-impact multi-disciplinary learning in the High School. Essential features include (1) Parallel Learning Groups (Modified Jigsaw Strategy), (2) Activity-based Multi-domain Learning, (3) In-school Comprehensive Student Portfolio, and (4) Strategic Study and Rest Periods. The program, implemented since school year 2002-2003 in a rural private high school in Bohol, proves to be a robust workable scheme even in its initial stages. It is student-teacher-administrator friendly and can easily be modified and adapted to different levels of affluence (or poverty) of public and private high schools. Although implemented with the 2002 Basic Education Curriculum (BEC), the program is compatible with other curricula. The program has resulted in the progressive enhancement of

cognitive and affective learning of students, with each year's graduates, on the average, exceeding performance levels of the previous year. This is shown by external checks of performance such as the number of students who pass the University of the Philippines College Admission Test (UPCAT).

Keywords: multidisciplinary learning, innovative strategies, secondary education

Introduction

Globalization has come upon us, stunning in its swiftness and breadth of scope. The full impact of the phenomenon cannot even be seen yet. Nations brace against, or take advantage of, global market forces, rapidly increasing flux of intercontinental migration of human resources and transport of goods, waxing and waning of population in different parts of the world. Rich and poor, young and old, have quick and easy access to information — important or trivial, useful or harmful. Now, more than ever, every nation is forced to adapt to new conditions with the whole world in dynamic transition.

New standards of quality. With globalization, standards of quality of human resources, products, and services are pegged with those of the most advanced nations. *Today, there is much less tolerance for mediocrity.* Nations that rise to the challenge of quality performance and quality services march on to higher levels of development. Nations that waver get mired in backwardness, deteriorating standards of living, and humiliation in the international community. No amount of excuses and blame throwing can sugarcoat images of underdevelopment flashed on television and computer screens all over the world.

Education: A key factor. Education is universally acknowledged as a singular factor affecting the quality of a nation's human resources, products, and services. Members of the European Union and Japan, among other advanced countries, have recently introduced significant reforms in their educational system to respond to the needs of new and rapidly changing economic and socio-political conditions. Universities in Germany, aside from the traditional university *Diploma* and German doctorate, now offer baccalaureate, masteral, and doctoral degree courses similar to the shorter educational track of the USA. In April 2002, Japan cut down from a 6-day to the 5-day school week common in the USA and Europe.

In the race to produce highly skilled manpower for global needs, there is additional pressure. There are highly publicized international standardized tests and measures of performance such as the Programme for International Student Assessment (PISA) of the Organization for Economic Cooperation and Development (OECD) and the Trends in International Mathematics and Science Study (TIMSS). These tests are administered every three years to 15-year-old and 13-year-old schoolchildren, respectively, in participating countries. Moreover, aside from these international tests, there is publication on-line of the scores of all team members in elite international competitions

such as the International Mathematics Olympiad (IMO). These reflect the quality of a country's youth development programs.

It is clear, therefore, that no nation, advanced or underdeveloped, can afford to be lethargic or insensitive to the demands of the present times for quality in all aspects of human endeavor.

Coping with the new challenges of the 21st century, especially for underdeveloped countries, is daunting. With old paradigms seen to be insufficient, it is a formidable task to find new structures that could boost human development. What educational programs can develop a nation's human potential to the utmost? What programs can promote fullest growth, development, creativity, and productivity for the youth? What programs can generate higher levels of development for a country by the cultivation of a healthy, cultured, and socially responsible citizenship? How can educational programs take advantage of the powerful methods and tools of the social and physical sciences, engineering, and high technology now so easily accessible? How can an underdeveloped nation overcome severe constraints of poverty, low standards of living, and formidable cultural barriers?

Innovative strategies. We talk about some innovative strategies for developing science culture and education in the Philippines. Because these encompass multi-dimensional problems that would require volumes for proper presentation, here, we shall focus on small but significant parts for which we have come up with modest but real and workable solutions.

Background Study

Present conditions in the Philippines

The current situation of Philippine education presents problems and challenges of staggering proportions. It is clear that the educational system of the Philippines has failed to advance human development and improve living conditions. On an international scale based on the 1999 Human Development Report published by the United Nations Development Programme (UNDP) [1], no province or region in the Philippines, not even Metro Manila, may be regarded as having high human development. Two provinces, Lanao del Sur and Sulu, fall in the category of low human development, all the others are in the medium category¹. In the area of basic education, the Philippine Human Development Report (PHDR) 2000 [2] notes that, despite the country's high literacy rate of 94.6% , the Philippines manifests low levels of student achievement both in standardized international tests and national assessments:

¹ Measures of human development are given in terms of the Human Development Index (HDI). Computations of the HDI include life expectancy, literacy and enrolment, and real per capita income [2].

- The Philippines ranked 39th out of 42 participating nations in the Third International Mathematics and Science Study (TIMSS) released in 1996. In the test, Singapore, South Korea, Japan, and Hongkong were the top scorers. Highly industrialized countries such as the USA, the United Kingdom, France and Germany were near the median grade. The Philippines' Southeast Asian neighbor, Thailand, ranked just above the USA.
- In the TIMSS-Repeat released in 2000, the Philippines ranked 36th of 38 in both Science and Mathematics.
- In the IMO 2003, the Philippines placed 79th out of 82 participating countries, with a Team Score of 9 points out of a possible Team Score of 252 points (3).
- In the National Elementary Achievement Test (NEAT) and the National Secondary Achievement Test (NSAT) administered since 1994², on the average, Grade VI pupils and senior high school students gave correct answers to less than 50 % of the given questions. In the 1996 NSAT, if 50% is used as the passing mark, only 8.3% of public school students in Metro Manila passed the test.

What are the immediate causes of the low achievement of Filipino schoolchildren? Studies indicate the factors that affect the quality of education in the Philippines.

1. **Teachers are ill prepared in both subject matter and pedagogical skills.** "The poor quality of basic education is merely a downward transmission of the mediocrity pervading the country's entire university system, which is the ultimate source of elementary and high school teachers [2]." The 1998 results of the Licensure Examination for Teachers (LET) showed mean scores of only 38% for elementary, and 43% for high school teachers [2]. Furthermore, a 1998 study of the Science Education Institute (SEI), Department of Science and Technology

² Prior to the NSAT, there was the National College Entrance Examination (NCEE) from 1973 to 1993 and abolished by Republic Act 7731 in 1994.

³ www.sei.dost.gov.ph/survey/pdf. The government has undertaken stronger measures to improve teacher quality especially in the basic sciences and mathematics. DOST gives special scholarships to those taking Bachelor of Secondary Education major in Physics, Chemistry, and Biology. There is also Project RISE (Rescue Initiatives for Science Education) for implementation in 1998 - 2003, due in part to the poor performance in the TIMSS. However, the poor performance in the TIMSS-Repeat was again a disappointment. It is also worthwhile to mention here a troublesome point. In the 2002 LET, the field of specialization of the physical sciences included physics, chemistry, and general science. With such a mix of broad subject areas such as physics and chemistry, most questions could not be otherwise but rote-style. One of the authors of this paper (MVCB), as a physicist and 2002 LET examinee, noted that passing the physical sciences area may not mean being qualified to teach *either physics or chemistry*.

(DOST) found only 80% of math, 34% of chemistry, 27% of physics, 44% of biology, and 42% of general science teachers qualified to teach (with a full undergraduate education/science major) [4].

2. **Classes in public schools are fairly large**, with an *average* class size of 50 in high schools [2]. Some classes have over 70 and even a hundred students [5].
3. **There is a serious lack of textbooks, instructional materials, and laboratory equipment.** In 1999, in elementary schools the per pupil book ratio was 0.33 (or one book per three pupils) in Science. For the high school, the ratio was 0.13 in Science, 0.11 in English, 0.15 in Mathematics [2].
4. **In many areas of the Philippines, poor living and learning conditions prevail** (lack of electricity and running water, poor hygiene, and lack of, or substandard, classrooms in rural areas) [2].
5. **An overloaded curriculum** is seen as a major factor affecting achievement levels of schoolchildren. For example, the Philippine science syllabus contains more topics than the syllabi of high-performing nations in the TIMSS. Too many topics are covered at the expense of mastery of skills and greater concept understanding [6].
6. **The medium of instruction is seen as a problem** [2]. There is the dilemma in the Philippines at present of, on one hand, facilitating learning by using the national language, Filipino, or the local regional languages, for instruction and, on the other hand, fostering mastery of English as the emergent world *lingua franca*. Article IV, Section 6 of the 1987 Philippine Constitution mandates Filipino to be the medium of instruction. However, present educational programs follow the 1974 Bi-lingual Education Policy stipulating the medium of instruction as English for Mathematics, Science, and Communication Arts and, for all other subjects, Filipino is the medium of instruction. A newly released 2003 Department of Education (DepEd) Order now advocates use of English in all subjects except Filipino after noting the poor English skills of graduates of the whole educational system. However, compliance with this new order may not be immediate.

The PHDR 2000 shows the hierarchy of quality of schools: private sectarian, followed by private non-sectarian, then the public schools. Some private sectarian schools offer quality education comparable with the best schools in the world. There are, however, top-performing special public schools with science-oriented curricula. These are the science high schools established by national and city governments. These have larger budgets than regular public schools, and enrolment is limited and highly selective. These schools generally follow the curriculum of the Philippine

Science High School and produce high achievers. In Bohol, for example, the Tagbilaran City Science High School, established only in 1996, ranked first in the province in the 2000 and 2001 NSAT.

It is evident that there are excellent schools in the Philippines. There are schools whose graduates go on to good universities in the country and abroad. Several graduates of the Philippine Science High School have gone on to Princeton University, Harvard University, and other top universities in the USA. There are students who get medals in international mathematics competitions, science and technology fairs, debates, musical and art competitions. However, "the problem of basic education is not really about developing an elite that can be showcased: it is about improving the lives of many who, for better or worse, are relegated to the public school system" [2]. This is especially urgent inasmuch as the distribution of enrolment in public and private schools, according to level, are 90% in public and 10% in private elementary schools, 60% in public and 40% in private high schools, 15% in public and 85% in private colleges and universities.

The Philippines faces the grim scenario of an ineffective basic education system, producing every year thousands of young people with low levels of competence, functional literacy, and social responsibility. For example, consider the fourth year level, of homogeneous grouping, in a sample high school. If there are four sections of 40 students each, the present state of basic education may give a generous estimate⁴ of 35 of the honor section, 20 of the second, 15 of the third, and 10 of the last section, becoming functionally literate when they finish high school. This leaves 50% or 80 students graduated at low levels of proficiency. Considering that a 1998/99 census gives 5 million high school students [2], a rough estimate gives 625,000 students graduated each year who may not be functionally literate, and at worse, may be a burden to society. In four years, 1999 - 2003, neglecting yearly rise in enrolment, the number accumulates to 2.5 million underdeveloped low productivity graduates. And these numbers will continue to increase if there is no reform of the system.

Major Reforms in Philippine Basic Education.

For decades, the Philippines had been continually confronted by the problem of basic education and the development of its human resources. How shall the country attain the fullest possible growth and development of its youth? How can its educational system produce graduates who can contribute in real terms to the country's progress and development? More specifically, questions asked before and still asked now are: "What kind of Filipino do we want to develop? Are we going to educate the masses or pour our resources on the few intellectual elite who will become leaders? Shall we educate for the individual's sake or for society? [7]" There is a follow-

⁴ Note, this is a generous estimate since, one could extrapolate from the 8.3% in Metro Manila passing the 1996 NSAT with scores 50% and above.

up question: *Have we poured out our resources to train our intellectual elite only to have them migrate and use their training in the advanced countries?* (Compare the per pupil operating cost of P 36,899 for the Philippine Science High School at Diliman, Quezon City, and P 1,396 for regular public schools in 1996 [2].) These questions are difficult to answer and are broad in scope. In the Philippine context, they must also be solved in a country burdened with poverty, underdevelopment, and billions of dollars in debts.

In *Philippine basic education 1999-2004: Analysis, recommendations, and plans*, an essay in the PHDR 2000, A. Gonzalez notes the poor pupil performance in national assessments and the "failure to get out of the groove (of almost three decades now) of achievement at the 50 percent level (half of what is taught in the prescribed syllabus)[2]." This is despite the fact that, in this period of *thirty years*, there is no dearth of measures undertaken by the Philippine government to reform or revitalize basic education in the country. The Educational Decree of 1972 reorganized the country's educational system based on findings of the Presidential Commission to Survey Philippine Education (PCSPE). Ten years later, the Education Act (EA) of 1982 gave a blueprint for achieving national goals through a reformed educational system. The New Elementary School Curriculum (NESC) was implemented in 1983. Then the change in government in 1986 and subsequent ratification of a new constitution, the 1987 Constitution, redefined the goals of education and emphasized values formation. The NESC was maintained, while a New Secondary Education Curriculum (NSEC), following objectives set in the EA of 1982, was implemented in 1989. At present, the NESC and the NSEC are being scrapped. Attention is on the 2002 Basic Education Curriculum (BEC) implemented in public schools in the School Year (SY) 2002-2003. The 2002 BEC, perceived to differ radically compared with the NESC and NSEC, responds to recommendations of the Presidential Commission on Educational Reform (PCER) in its report, *Philippine Agenda for Educational Reform*, published in 2000 [6].

Clearly, the measures taken so far by the Philippine government, in the period of thirty years mentioned above, have been remarkably inadequate or ineffective. In fact, instead of improvement, a continuing retrogression is perceived. The PHDR 2000, in offering policy recommendations, paints a bleak picture of having "to pull basic education out of the deepening rut of mediocrity in which it finds itself [2]." At present, the 2002 BEC claims to contribute toward a better solution to the many-faceted problem. However, it remains controversial and the private schools are slow to implement the new curriculum. There is confusion over the new curriculum exacerbated by the DepEd itself. After a year of implementation of the 2002 BEC in the public schools, already the DepEd has changed the implementing guidelines for the SY 2003-2004, on short notice, with significant changes of time allotment and grading system compared to the SY 2002-2003 version [8]. The perceived instability casts more doubt on the efficacy of the reform.

The dismal situation of Philippine basic education could remain for many more years. In 1999 there were 12 million elementary school pupils and 5 million high school students, and the numbers are increasing every year. Public education costs exceed available funds from government and foreign aid at mind-boggling amounts. With this come problems of shortage of classrooms and instructional materials. Moreover, poor quality graduates of the basic education system and the mediocre performance of tertiary level schools add yearly to the numbers of ill prepared teachers.

Cultural Factors

Poverty of a nation leads to lack of quality human and physical resources that, in turn, leads to low quality education, which leads back to poverty. Can this vicious cycle be broken? Is it a matter of *money*? One way commonly subscribed to by governments is to get massive foreign loans. However, in the Philippines, as in many other poor countries, this has failed to bring about desired results. Indeed, these countries have only found themselves without significant economic improvement and deeply mired in foreign debt.

Are there hidden factors? An examination of the series of national programs for reform of the Philippine educational system in the past thirty years reveals laudable efforts of the government, *on paper*. In terms of conceptualization, design, target outcomes, and implementation schemes, the steps taken by the Philippine government, whether in curriculum reform or education budget allocation and finance, seem not only reasonable but also workable. However, the dismal results are always contrary to expectations. Has the effect of socio-cultural factors been grossly underestimated? What specifically are these socio-cultural factors? Are there attitudes and preferences uniquely Filipino that hinder the efficacy of educational systems and teaching methods developed in the West? The Philippine Department of Education (DepEd) has received, and continues to receive, substantial foreign aid and loans from the USA, the European Economic Community, Japan, and Australia [2]. Aid usually comes with recommendations for adoption of certain pedagogical strategies, and training of Philippine educators in the methods, used in the donor countries. Are these methods suitably adapted to the situation of schools and students in an underdeveloped Third World country such as the Philippines?

Money is not the problem; culture is the problem. With the successive failure of measures taken by the Philippine government, it is indeed urgent to look into the Philippine people themselves, for the government and the bureaucracy reflect in a significant way the behavior of the people. In the final analysis, the breakdown of implementation may be traced from the top to the bottom of the delivery system from the President, to the Department Secretary, to the rank and file of the Department, to the simple teacher in a simple classroom in some far-flung area. Then, too, the communities in which the schools are situated form a strongly influencing factor as the immediate social milieu.

In an analysis of the intellectual development of Voltaire, it is noted that, for Voltaire [9] (underscoring ours),

to get to know the inhabitants of a country, the critic must work in the same way. He must first analyze the *nature of their thought*, the *quality of their action*, the *goal which their action is designed to achieve*, and the *modifications which are introduced into their manners, their arts, their institutions, their science*; then he must reduce their intellectual activities with their creative results to some sort of common denominator.

In the Philippines, such an undertaking would be very useful. It is important, and urgent, to look at the effect of cultural factors in considering any educational reform. It is not easy, and may be offensive to the Philippine people themselves, but it is necessary if real change for progress is to be achieved. In any case, it should be a consolation to know that *a new culture can be developed*, assimilating the good parts of the old, while generating new attitudes and behavior to cope with new conditions. Here we mention examples of values and attitudes of Filipinos in general which may also manifest in DepEd officials and personnel, school administrators, teachers, and students. We highlight them singly for emphasis even if the attitudes are related.

- **Culture of dependence.** Several generations of Filipinos grew up, and are growing up, aware of massive government loans to finance the development of the country. Large-scale infrastructure development such as highway networks are built by foreign construction companies even as the country produces hundreds of civil engineers and road-building is, by now, ancient technology which should be done by a nation's own engineers. Many government buildings are constructed from foreign aid or loans granted by countries such as Japan and the USA. Schools and universities run by international religious orders get substantial aid from their respective Mother Houses in the advanced countries. There may be too many nice buildings around with plaques indicating grants from JICA, USAID, among others. Although it is well to appreciate such foreign aid, several generations of Filipinos may have grown with the mendicant attitude of seeing *progress made possible only with foreign loans and grants*.

On a smaller scale, habits and preferences of different social classes (especially the middle classes) in the Philippines are quite different compared with that of advanced countries. For the former, parents, siblings, or even maids may do the child's homework or school projects *to help the child*. In the advanced countries, children are naturally encouraged to be independent, *to do their own work and to do it well*.

- **Underdeveloped virtue of honesty.** There is rampant cheating in schoolwork, examinations, evaluations, and thesis work. The most recent high-profile case of cheating is leakage in the 2003 Bar examinations for lawyers. There is also anecdotal evidence that a number of school reports and data, required for school permits and DepEd evaluation, are unreliable. Moreover, the Philippines is “blacklisted” with rampant piracy and violations of international intellectual property laws. There is also the widespread production, sale, and purchase of fake merchandise assuming internationally well-known brand names.
- **Low standards of quality.** This has been referred to as the *puwede na yan* attitude. There is a lack of importance given to a job well done according to external objective standards. In the education sector, textbooks and instructional materials are generally of low quality. An interesting example of low quality instructional tools came up in an actual laboratory lesson given by one of the authors (MVCB) on precision and accuracy of scientific measurements. We discovered that many rulers sold in stores differ in measurements sometimes by as much as two millimeters.
- **Skewed priorities.** In considering *the goals which the Filipinos’ actions are designed to achieve*, we observe importance placed on *personal or filial advancement over national progress and development*. There is an observed lack of motivation for good citizenship, obedience to the law and diligent fulfillment of duties and responsibilities for the general welfare of the entire nation.
There is emphasis on *immediate returns over solid long-term benefits*. The anticipation of finished products and “turn-key” infrastructure overshadows the important part of the step-by-step *process* of preparation, construction, testing, and improvement. This is true not only for infrastructure and government programs but also for scholarly work. For example, it is common knowledge that the sale of ready made theses and dissertations is a thriving business.
- **Poor concept of time and discipline in keeping schedules.** “Filipino time,” “whole-day” meetings, drama rehearsals, and music practices (with much time spent on interpersonal catching-up and gossip), class periods consumed in homilies and stories are commonly observed.

Such values and attitudes that lead to dysfunctional behavior in the Philippines have to be considered for an effective educational reform. Teachers and students exposed daily to shoddy workmanship and non-professional behavior generally think this is the norm. The matter of skewed priorities could very well be the reason for rampant graft and corruption in government and the bureaucracy (including the

Department of Education), and fraud and dishonesty in the country's business sectors (including those involved in the manufacture, publishing, and sale of educational materials). Dependence and parasitism are also encouraged by tolerance of cheating, and low levels of honesty, even of school officials and teachers in times of local and national testing and evaluation such as the NCEE or the later version, the NSAT. There is anecdotal evidence that various gimmicks are resorted to in order to increase school or division scores. These include allowing only selected students to take the exam, or encouraging "sharing" of answers by honor students with slower ones.

Checks and inhibitors should be integrated with any program for educational reform if it is not to break down just like all the other programs given in the earlier part of this paper. An obvious historical analogy is the system of check and balance in the US government system comprised by the executive, legislative and judicial branches. This system incorporates the assumption of natural human weaknesses.

CVIF Dynamic Learning Program: A Low-cost Viable Solution

Considering the present conditions in the Philippines, is it possible to have a low-budget yet effective educational program that:

- Is suitable for large classes common in the Philippines?
- Requires a smaller number of textbooks?
- Requires less science equipment?
- Reduces teaching personnel requirements?
- Is less dependent on the abilities and personalities of teachers?
- Has built-in checks of dysfunctional behavior observed in Filipinos?

It is possible. In the following sections, as a micro-level prototype and springboard for larger scale solutions, we describe some salient features of a new learning program implemented since SY 2002-2003 in a rural private high school, the Central Visayan Institute Foundation (CVIF), formerly the Central Visayan Institute. We emphasize, however, that with the magnitude of the problem of education, solutions are naturally multi-dimensional and what we present here can only be a fraction of what we are actually doing. In particular, we focus on strategies to improve scholastic achievements in a progressive manner with no short cuts. Many cultural factors and development of new attitudes are intrinsically integrated with the strategies for academic work. For brevity, we shall mention these attitudes whenever applicable and not in a separate section.

¹ As distinguished from schools accredited by the Philippine Accrediting Association of Schools, colleges and Universities (PAASCU) which enjoy a certain degree of autonomy from the Department of Education.

The CVIF is located in Jagna, a town with a population of about 24,000, in the province of Bohol, 63 kilometers southeast from the only city of the province, Tagbilaran City. The CVIF is among the private schools under the supervision of the DepEd, Division of Bohol⁵, which in turn is under the direct supervision of the Regional Office for Region VII (Central Visayas Region) in Cebu City. In 1999, the CVIF was nearing closure and suffered from all the problems mentioned in the PHDR 2000. These include large classes, lack of updated textbooks and instructional materials, teachers lacking proficiency in subject matter and pedagogical skills, poor learning and living conditions in a rural community, and lack of funds (tuition fees were P 2,400 *per year*). At the CVIF, seemingly overwhelming difficulties had to be tackled one by one, in a difficult-case scenario, until positive results could be observed. In SY 2002-2003, in an effort to fast-track improvements, the CVIF joined the public schools in implementing the 2002 BEC. However, new features were introduced at CVIF so that the whole scheme, which we call, for brevity, the CVIF Program, could address multi-pronged problems in a more effective way.

The CVIF Program developed out of our actual observations and firsthand experiences for more than four years as principal, consultant, and/or classroom teacher handling General Science, Chemistry, Physics, and Geometry in several sections in the first, third, and fourth year levels. The program makes use of many ideas of classical and modern pedagogical theories while maintaining a pragmatic approach. The theories were adapted, developed, and used with real classroom problems in a non-urban Philippine setting, reflecting the conditions and cultural factors described in earlier sections. For example, we worked subject to the constraint typical in rural settings: low educational levels of parents. (For SY 2003-2004, with 439 CVIF student respondents, the highest educational level reached by *at least one parent or guardian* showed 52.84% post-high-school, 38.95% high school, and 8.20% pre-high-school.) This factor is important in the school's program for enhancing language learning abilities of the students.

After its second year of implementation in SY 2003-2004, the CVIF Program has proven to be a robust workable scheme. Since most classroom problems we encountered, and offered solutions to, are also present in public schools, the program may find application there, perhaps with suitable modifications. On the other hand, affluent private schools, with bigger budgets and more access to high technology, can easily enhance the model for marked gains in performance⁶. Moreover, although the CVIF program was implemented with the 2002 BEC, the program is simply a platform that can

⁶ It may be of interest to the reader that the authors considered distinguished physicists and mathematicians as models of effective self-learning and sophisticated abstract thinking when they were in the high school stage. Examples are Richard Feynman and Freeman Dyson. We studied their learning styles for application in the education of gifted children in our school.

⁷ We do not, however, exclude application, in a suitably modified form, to elementary schools.

accommodate different curricula such as the 1989 NSEC and special science curricula for science high schools.

Initial focus on the high school. The CVIF Program was developed and applied in the high school⁷. In the Philippines, high school covers the ages 13 to 17 years old. This is the adolescent stage characterized by significant physiological changes and achievement of mental maturity. The high school stage coincides with Jean Piaget's last stage in development theory - the *formal operations stage* [10]. During this stage, the young person typically develops complex logical thought processes and is capable of abstract thinking. As he reaches the later adolescent stage, most of the additional mental structures necessary for logical, mathematical, and scientific reasoning are completed. In the affective learning domain, it is during this period that the young adolescent especially anticipates adulthood and professional life.

Limited efficacy of traditional schemes. Present conditions in the Philippines severely diminish the efficacy of traditional teaching methods developed in the West because:

- Classes are simply too large. In advanced countries, there are 15 to 25 students per class. Most private schools in Philippine urban areas typically have 30+ or even 40+ students in each high school class. Public schools, as mentioned earlier, have even larger numbers. It would be very difficult, even for excellent teachers, to monitor the progress of all the students in a large class. In general, the fast learners, or high profile, self-confident students dominate in large classes handled in traditional ways.
- Traditional teacher-centered methods generally boil down to the lecture style in day-to-day practice during the school year. This fosters passive learning that is too dependent on the abilities of the teacher. Moreover, teachers unprepared with the lessons for the day, or faced with unruly students in large classes, resort to homilies or stories. Moreover, noting the number of unqualified or poorly prepared teachers, the heavy concentration of lectures and speaking on the part of the teacher boosts the transmission of wrong ways of thinking and poor language skills.
- In a country where there is a culture of dependence, students are more prone to depend on the teacher, classmates, and relatives for their learning. There is a diminished motivation to analyze problems on their own, and do deep thinking on important topics.

Traditional schedules of classes are constrained by the number of sections and available teachers to have science and math classes towards noontime or in the afternoon. These are non-peak hours for learning when students may be hungry, tired,

and generally restless, especially in a tropical country such as the Philippines. [See the prototype class schedule for public schools given by the DepEd on the following page.] We now introduce the important components of the CVIF Program for Dynamic Learning. Some features are not entirely new in the sense that they have similarities with the Individual Instruction method or Personalized Education Program implemented in schools such as St. Scholastica's College [11] and the Poveda Learning Center [12] in Metro Manila, respectively. This is also true for schools applying the Montessori method. However, such programs are known to be expensive due to the cost of special instructional materials and modules. Indeed, tuition and other fees may reach up to P 60,000 and P 80,000 per year in these schools. In contrast, the CVIF Program has been observed to raise achievement levels of students even as they paid tuition and other fees of P 5,795 for the whole school year 2003-2004. This is why we propose the Program, or suitable modifications thereof, as a low-budget alternative.

Table 1. Prototype class schedule showing the increase in the teaching time in Science I to III.

Time	Subject
6:40–7:40	MAPEH
7:40–8:40	English
8:40–9:40	Math
9:40–9:55	Recess
9:55–10:55	TLE
10:55–11:55	Science
11:55–12:55	Lunch Break
12:55–1:55	Filipino/EP
1:55–2:55	AP

Total number of hours: 8 h

From: DEP ED Order No. 37, s. 2003: Revised Implementing Guidelings of the 2002 Secondary Education Curriculum Effective School Year 2003-2004.

The essential components of the program given here are (i) Parallel learning groups, (ii) Activity-based multi-domain learning, (iii) In-school comprehensive student portfolio, and (iv) Strategic study/rest periods.

Parallel Learning Groups (Modified Jigsaw Strategy)

A very important component of the CVIF Program is the *parallel learning groups*. This means that three sections of a given year level have the same subject all at the same time. (See the sample Class Program (Table 2) on the following page.) The

immediate question would be how one teacher could handle all the science classes if they are conducted at the same time. This is where the *Expert Teacher/Facilitator* (Figure 1) set-up comes in:

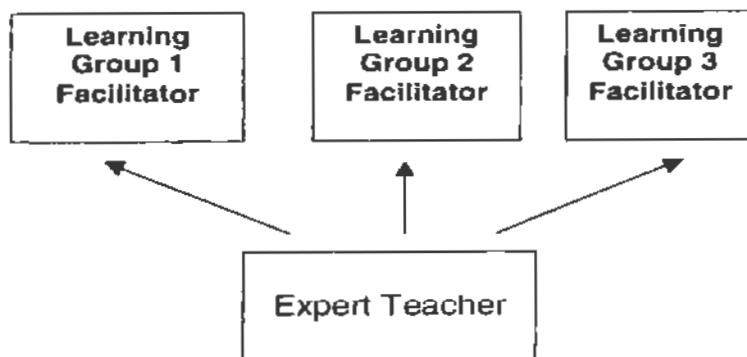


Figure 1. Expert teacher/facilitator set-up of the CVIF program.

The expert teacher is responsible for a particular subject. He/She prepares the concept notes and exercises, and is responsible for grading activities, quizzes, and exams. During the allotted time for the subject, the expert teacher chooses the Learning Group (or section) where a lecture or discussion will be conducted. Since the expert teacher should not lecture for more than twenty minutes, on the average, other sections can be visited while the students are doing activities during the rest of the period. The activities may be in the form of drills, exercises, taking of concept notes, drawing, and learning stations, among others. While the students are doing their activities, the facilitators (who are also licensed and expert teachers of other subjects) take charge of the class. The facilitators *do not discuss nor interfere with the activities of the students*. They merely make sure that the students are doing the activities for the day, and classroom conditions are conducive to learning. Questions on the subject matter are forwarded to the expert teacher. The students are thus constrained to work independently. This leads to Bruner's development of the independent learner "in which instruction aims to help the learner be a self-sufficient problem-solver. This means that the learner must not be permanently dependent on his teacher's correction of errors, but must be able to take over the corrective function. This self-monitoring behavior is a goal of cognitive learning [13]."

The idea for the Parallel Learning Groups was inspired by the Jigsaw Strategy devised by Professor Elliot Aronson in 1971 in Austin, Texas, U.S.A. [14]. In the original Jigsaw Strategy, students were grouped into so-called home groups and expert groups.

Table 2. Sample Program of CVIF

CENTRAL VISAYAN INSTITUTE FOUNDATION

Jagna, Bohol

CLASS PROGRAM

SCHOOL YEAR 2003-2004

MONDAY

	Mins.	IA R-201	IB R-202	IC R-203	IA R-209	IB R-208	IC R-210	IA R-105	IB R-106	IC R-207	IA R-301	IB R-302
7:30-7:40	10	F L A G C E R E M O N Y										
7:40-8:55	75	SCIENCE I	SCIENCE I	SCIENCE I	SCIENCE II	SCIENCE II	SCIENCE II	MATH III	MATH III	MATH III	MATH IV	MATH IV
8:55-9:15	20	R E C E S S										
9:15-10:30	75	MATH I	MATH I	MATH I	MATH II	MATH II	MATH II	SCIENCE III	SCIENCE III	SCIENCE III	SCIENCE IV	SCIENCE IV
10:30-11:45	75	ENGLISH I	ENGLISH I	ENGLISH I	FILIPINO II	FILIPINO II	FILIPINO II	FILIPINO III	FILIPINO III	FILIPINO III	ENGLISH IV	ENGLISH IV
		N O O N I N T E R M I S S I O N										
1:30-2:45	75	FILIPINO I	FILIPINO I	FILIPINO I	ENGLISH II	ENGLISH II	ENGLISH II	ENGLISH III	ENGLISH III	ENGLISH III	FILIPINO IV	FILIPINO IV
2:45-4:00	75	Makabayan (E.P. I)	Makabayan (E.P. I)	Makabayan (E.P. I)	Makabayan (Aral. Pan. II)	Makabayan (Aral. Pan. II)	Makabayan (Aral. Pan. II)	Makabayan (Aral. Pan. III)	Makabayan (Aral. Pan. III)	Makabayan (Aral. Pan. III)	Makabayan (Aral. Pan.)	Makabayan (Aral. Pan.)
4:00-5:00	60	Makabayan (TEPP I)	Makabayan (TEPP I)	Makabayan (TEPP I)	Makabayan (TEPP II)	Makabayan (TEPP II)	Makabayan (TEPP II)	Makabayan (TEPP III)	Makabayan (TEPP III)	Makabayan (TEPP III)	Makabayan (TEPP IV)	Makabayan (TEPP IV)

It is called Jigsaw because each student's part, as they move from the expert groups to their particular home groups, is essential for the successful achievement of objectives.

In the CVIF adapted form, we reversed the procedure. Instead of students, the expert teachers and facilitators cooperate to facilitate the learning process.

The parallel learning groups are very important to maintain the effectiveness of the other component that is the Activity-based Multi-domain Learning. Once the expert teachers stay for whole periods with their classes, the tendency is to revert to the traditional teaching methods such as lectures and repeated explanations of the same topic*. There is also the tendency for the teacher to move on to the next topic when fast learners in the class give the impression that they are ready to move on. This is because quiet students are generally observed to acquiesce to the dominant mood set by high-profile students whether or not they have learned the subject matter well. In contrast, the parallel classes scheme allows more students to have more time for absorption and mastery of lessons. The set-up also constrains the expert teachers to prepare good activities for the periods when they are not within the classes and students have to learn independently.

There are other advantages of the CVIF Program's parallel learning groups. It is robust against teacher absences. It promotes higher interaction between teachers. Poor performing teachers are pushed to better performance as they move from one class to another as facilitators or expert teachers and are exposed to the activities given by good teachers. The facilitators also learn teaching strategies used in other subject areas.

Activity-based multi-domain Learning

It is said, "the most effective learning takes place where there is a maximum of mental activity [13]. Activity-based learning, combined with the parallel learning groups scheme fosters Kohlerian insight learning % the students gain insight as they independently go through the "gradual process of exploring, analyzing, and restructuring perceptions until a solution is arrived at [13]" This enhances critical thinking, mastery of basic principles, and deep understanding of lessons. This contrasts with rote learning or simple-minded accumulation of disjoint information, trivial or non-trivial, which can be accessed through the Internet or traditional libraries.

Problem-based learning. Strategies recommended include problem-based or inquiry-based learning and the discovery approach. For example, in class, the expert teacher gives an activity on a new topic. The students work on this activity for a whole period *without* a lecture, discussion, or demonstration from the teacher. The facilitator

* In the words of an Assistant Schools Division Superintendent, "We let teachers attend many seminars and training programs on teaching strategies. However, when we go around, we find them resorting to the traditional lecture style."

takes care of classroom management during the period. By the time the expert teacher visits the class, the students already have particular questions or problems in mind. They are then able to give directed questions that have direct bearing on the problems they tried to solve earlier. The flash of insight or understanding is more often observed than in traditional situations where the teacher introduces the topic, lectures, explains, and gives examples, before the students work on the lessons. With the CVIF program, many students are able to solve problems and exercises, such as physics problems, even without prior explanation of the topic. The expert teacher simply reinforces correct understanding, points out common errors, or compares the merits of different approaches and solutions.

Learning stations. Part of the activity-based learning program is the maximal use of learning stations in laboratories. This is recommended especially for schools with limited facilities. Even with only one or two available set-ups for one science experiment, learning stations for different experiments can be set up so students can go from one learning station to another. At the CVIF, learning stations have also been set up for math classes. Examples are exercises in making accurate measurements and converting units.

At the CVIF, students normally work in pairs at a learning station. The maximum number in a group is three. This avoids large dysfunctional groups commonly observed in many schools in the Philippines, where classes of 40 or more students are divided into eight or ten groups depending on available laboratory equipment. Considering the culture of dependence of Filipinos, for groups of more than three members, there will be non-functioning members who will rely on the others. The learning process is superficial in this case.

The discovery approach in which the students independently try to understand instructions posted at the learning stations also enhance language learning abilities. The association of verbal expressions with activities and equipment they can touch and manipulate provide potent stimuli for language learning.

Multi-domain learning. Activities are designed to enhance cognitive, affective, and psychomotor learning of students. For cognitive learning, emphasis is on problem solving, analysis, evaluation, synthesis, and creation. In the affective domain, learning is reinforced by the different components of the CVIF program. Attitudes and behavior such as self-discipline, thoroughness, diligence, accuracy, neatness, honesty, stamina, perseverance, patience, and attentiveness have been enhanced. Psychomotor abilities are used to reinforce cognitive and affective learning in an integrated manner. Students do a lot of drawing, graphing, cutting out of geometric figures, coloring, measuring, tracing, and creating attractive figures for their portfolios.

Less dependence on textbooks. Also, we observed less dependence on textbooks. At the CVIF, because of typographical and conceptual errors and confusing notation seen in many math textbooks, we did not recommend any math textbooks to the students. The teachers, guided by the principal, referred to several books and often designed their own activities for the students. It was clear, therefore, that the number

CENTRAL VISAYAN INSTITUTE FOUNDATION Jagna, Bohol 6308			
ACTIVITY SHEET			
Name: _____		Grade / Score: _____	
Year and Section: _____		Date: _____	
Please check the box for the type of activity.			
Concept Notes Skills / Exercises Math <input type="checkbox"/> Vocabulary <input type="checkbox"/> Talasalitaan <input type="checkbox"/> Spelling <input type="checkbox"/> Laboratory Report <input type="checkbox"/> <input type="checkbox"/>	General Science Biology <input type="checkbox"/> Chemistry <input type="checkbox"/> Physics <input type="checkbox"/> <input type="checkbox"/>	Drawing/Art Computer Education Translation Exercise <input type="checkbox"/> Theme: Formal <input type="checkbox"/> Informal <input type="checkbox"/> Music <input type="checkbox"/> Others: _____ <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/>
Activity Title: _____			
Learning Targets: _____			
Reference:			
Title _____			
Author _____ Page Numbers _____			

Figure 2. Sample activity sheet of CVIF

of textbooks required can be minimized in the program. A good set of reference books for the expert teachers would be sufficient.

Flow State. It is now a common line at the CVIF to talk about the so-called “flow state” or “state of total absorption in a challenging activity.” Young people quickly reach this state when working or playing on the computer [15]. This creates the problem of having classroom educational experiences that could compete in engaging the minds of students. It has become an important problem of education, especially nowadays, to help adolescent students achieve this flow state in classroom educational experiences that would give way to their full creative and problem-solving abilities. At the CVIF, however, teachers have remarked on *how difficult it is to take out students from their flow state while they are absorbed in their individual activity* even when the expert teacher comes in to check on the progress of their work.

The In-school Comprehensive Student Portfolio

In the CVIF Program, ordinary notebooks are optional. What the students have are color-coded in-school comprehensive student portfolios, one each for the different subject areas – Science (yellow), Math (white), English (blue), Filipino (green), and Makabayan (red). All activities are done *in school* and compiled in the portfolio. It is comprehensive because all activities, including quizzes and exams, are compiled in the portfolio.

The activity sheet. Activities such as concept notes, exercises, drills, drawings, themes and essays are done on the CVIF Activity Sheet (Figure 2) used by students of all year levels. Notice the features of the Activity Sheet.

(i) In analogy to the concept map, the student is given a full perspective of the four-year stay in high school and the formal areas of learning he shall encounter as he selects the type of activity he is to do, whether in biology, chemistry or physics, or the languages. This is important for the students' goal setting for his stay in High School. (ii) To develop intellectual honesty and introduce the methods of research, the student is asked to indicate the reference used for the activity. (iii) The Activity Sheet is not ruled. This develops discipline and creativity paradoxically *at the same time*. (iv) Clear and specific Learning Targets are written. (Note, the word *target* has more direct meaning for Filipino students, rather than the word *objective*. In the same way, ‘*velocity*’ has more direct meaning to an Italian student because the word ‘*veloce*’ is used in everyday life to mean ‘quickly.’) This focuses the mind of the student on the immediate objective of the activity or learning task.

In-school portfolio policy. With the CVIF Program, the portfolios cannot be brought home. Also all activities and projects are done in school and filed in the portfolio after each class period. This ensures that the students learn independence in doing their own work. How do parents check on their children's learning? In principle, parents are welcome to visit the school to see the progress of their children's

work. In practice, most parents look at the portfolios during the open classrooms after the quarterly evaluation and distribution of Report Cards.

An important question raised regarding the in-school portfolio policy was how students can study after school when they do not have notebooks with them. The answer to this is the importance of enhancement of high-impact learning and storage of knowledge in the students' long-term memory. It is *precisely* the fact that the students do not have their notes with them that they are forced to *think through* the concepts, problems, questions, and ideas they encountered in their school activities. This process of thinking without notes and books is found to enhance learning. According to Bruner's theory of learning: "Learning at its best is thinking, and thinking is the process whereby one makes sense of a hodge-podge of perceived facts through a process called either conceptualization or categorization [12]." This particular way of churning a problem or idea in one's mind without referring to notes or books has been observed in scientists. Indeed, physicists have been heard to remark on visualization "without books, pen and paper; such that if one is stranded on an island, he should be able to reconstruct the fundamental principles of physics."

This observation is now being applied in tests to measure aptitudes in science and math. An example is the DOST-SEI 2004 scholarship examinations [16]. A part of the battery is the tests of working memory or the ability to hold in the memory as many parts of a complex figure at a given time. The tests measure aptitude in the scientific cognitive abilities such as concept formation, logical reasoning, and pattern recognition. It is precisely these cognitive abilities that the *in-school* portfolio policy aims to enhance.

Cumulative scholarship. Starting with a single Activity Sheet on day 1 of the academic year, the activities are accumulated gradually. Then at the end of the school year, the student has a relatively thick portfolio for each subject containing *his/her* work for one school year. The portfolio reflects the output of the young scholars. Indeed, it is easy to see the similarity between a university professor writing a scholarly monograph, starting with a single page, and the young high school student accumulating his own scholarly work bound in the portfolio. Students have been observed to manifest a strong sense of accomplishment while bringing home their portfolios at the end of the school year. Even parents have remarked on this. Moreover, there is a marked contrast between, on one hand, the neatly written notes and colorfully drawn figures in portfolios and, on the other hand, traditional notebooks filled or half-filled with a mixture of notes, informal scribbles, doodles or even cartoons.

Supervisor-friendly. In traditional schemes, the principal may every now and then observe classes to monitor teacher performance. However, it is to be expected that teachers wittingly or unwittingly show their best when the supervisor or principal is around. Thus, there is no guarantee that professional performance of duties is carried out every day of the school year. In contrast, with the comprehensive student

portfolios, the principal is able to easily monitor the progress of student learning. The portfolios clearly reflect the correlation between the teachers' lesson plans and what have actually been accomplished in class.

Strategic Study/Rest Periods

MSEPP Day. To maximize learning time and allow more room for different focusing time of students, the CVIF class program has longer periods for the academic subjects. Academic subjects like Science, Math, English and Filipino, and some components of Makabayan are scheduled on Mondays, Tuesdays, Thursdays, and Fridays. Wednesdays are MSEPP (*Musika, Sining, at Edukasyong, Pangkatawan at Pangkalusugan*) days. This scheme solves the problem of having students tired and sweating after games and exercises when they report for the academic subjects.

No-homework policy. The no-homework policy of the CVIF program is not new. The "Father of Modern Education," Johann Amos Comenius, emphasized relaxation after study periods. Michel de Montaigne also promoted the enjoyment of leisure hours to enhance creativity and productivity. Subscribing to this philosophy, CVIF students do not have homework so they can enjoy wholesome leisure and family time and sleep early (by 8 or 9 p.m.). They can then be fresh and energized for the next day's schoolwork. This also takes into account modern day findings of health experts that young persons need eight hours of sleep and an additional one-fourth hour for every year of age under 18 years old.

Continuous Evaluation and Differentiated Approach

Continuous evaluation. Monitoring of performance and achievement levels is important in any new program. This is especially true when base line scholastic achievement levels are low. At the CVIF, the administration conducts regular in-school academic evaluations in addition to examination of student and teacher portfolios. The administration also monitors the performance of students from different year levels in similar learning activities. So far, progressive improvement has been observed.

In the absence of the NSAT, we have noted the performance of students in the UPCAT as a necessary external check. Five CVIF students passed the 2003 UPCAT while four passed the 2002 UPCAT. This came after a period of eight years without any passers. The last time was when four students passed the 1995 UPCAT, the highest record then for the school. Prior to this, just like other rural high schools in the country, one or two students passed every other year or so (generally the top honor students). The relatively good number of passers for the two *consecutive* years, 2002 and 2003, is suggestive of improvements in the school's academic program.

Another external check is the participation of CVIF students in the Mathematical Challenge for Filipino Kids Training Program conducted by the Mathematics Trainers

Guild (MTG) of the Philippines. For SY 2003-2004, eight students qualified for the training program. Only four participated in the 12-Saturday training program conducted in Tagbilaran City (63 km away from Jagna) from July 2003 till February 2004. Two CVIF students ranked second and third overall after the program, outscoring students from the Tagbilaran City Science High School and the Bohol Wisdom School, both prestigious schools in Tagbilaran City.

Differentiated approach. With the CVIF program, progressive improvement in scholastic performance is aimed at, and has been observed. It is, therefore, important that learning activities are designed in a differentiated approach, based on observed performance and potentials of the different year levels. Currently available commercial instructional modules fixed or pegged at predetermined scholastic levels may not be appropriate in this case. At the CVIF, the principal works with the expert teachers to make sure the levels of learning activities are suited to the abilities and academic background of the students. For example, in Math, which is a sequential subject, gaps in students' understanding of basic concepts have to be filled out first before they take on other topics. For SY 2003-2004, because of insufficient skills in algebra, third year students were taught Geometry in a way that patches up deficiencies in algebra and number theory. In the next school year, 2004-2005, with incoming third year students having a better background in algebra, the approach in teaching geometry will be accordingly adjusted and modified. This is also why continuous evaluation and monitoring of performance is important.

Other Recommendations

In the evaluation of the conditions that led to the implementation of the CVIF program, we are also led to *strongly recommend* the following:

1. **Immediate abolition of the course leading to the degree of Bachelor of Secondary Education (BSEd).** Instead, we propose a regular B.S. or A.B. degree in the field of specialization, with 18 credits of professional education courses. This policy is implemented in Scandinavian countries (which do well in the PISA) and other advanced countries. The foremost reason is that high school students, being in the Piagetian formal operations stage, are capable of formal abstract sophisticated thought processes. Clear expertise in the subject matter manifested by a teacher is of utmost importance in this case. The narrow intellectual gap between high school students and Philippine BSEd graduates generates pedagogical and didactic problems, including the widespread rote-style teaching and learning process especially in the science subjects.

As stated earlier in this paper, the poor LET performance of teachers is a cause of concern. Although still to be confirmed with studies, LET results seem to indicate that B.S. / A.B. graduates with education credits

do better than BSEd graduates. Actual classroom observations made by the authors have validated this especially in math and science classes. It would be an expensive and risky effort to simply try to improve the BSEd curriculum and/or retrain teachers. Indeed, again as mentioned earlier, mediocrity of classroom instruction has spiraled down from mediocre teacher preparation in universities and colleges. It is difficult to expect better BSEd graduates in the succeeding years.

2. **Separation of Physics, Chemistry and General Science as major subject areas in the LET.** The present 3-in-1 combination of Physics, Chemistry, and General Science as a single part (Physical Sciences) of the LET may produce teachers not competent enough to teach Physics, nor Chemistry, nor General Science.

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SCIENCE CULTURE AND EDUCATION FOR CHANGE Part II. Breaking Barriers Impeding Widespread Development of Scientific Manpower in the Philippines

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Abstract

Barriers hindering the widespread development of scientific manpower in the Philippines are examined. Specific measures aimed at breaking these barriers are proposed. These involve concerted effort of the government and private sectors. A small privately run research center in the island province of Bohol, which has gotten support from the Department of Science and Technology and foreign agencies on a project-by-project basis, is cited as an initiative with modest but real contributions.

Key words: science culture, scientific manpower, science education

In our society, there exist barriers preventing us from creating a pool of Science and Technology professionals that can make the country globally competitive. Because of these barriers, Philippine science has been drawing its strength only from a limited sector of the society. The factors which impede the development of our scientific manpower are identified in this paper as the following: (1) a language problem (English) which discourages many scientifically inclined children at the grassroots level, (2) the lack of geographically accessible educational centers of excellence, (3) the lack of qualified Ph.D. research advisors, and (4) the brain drain phenomenon. The situation is illustrated in Figure 1 next page where each barrier acts like a sieve that filters out students with talents for science.

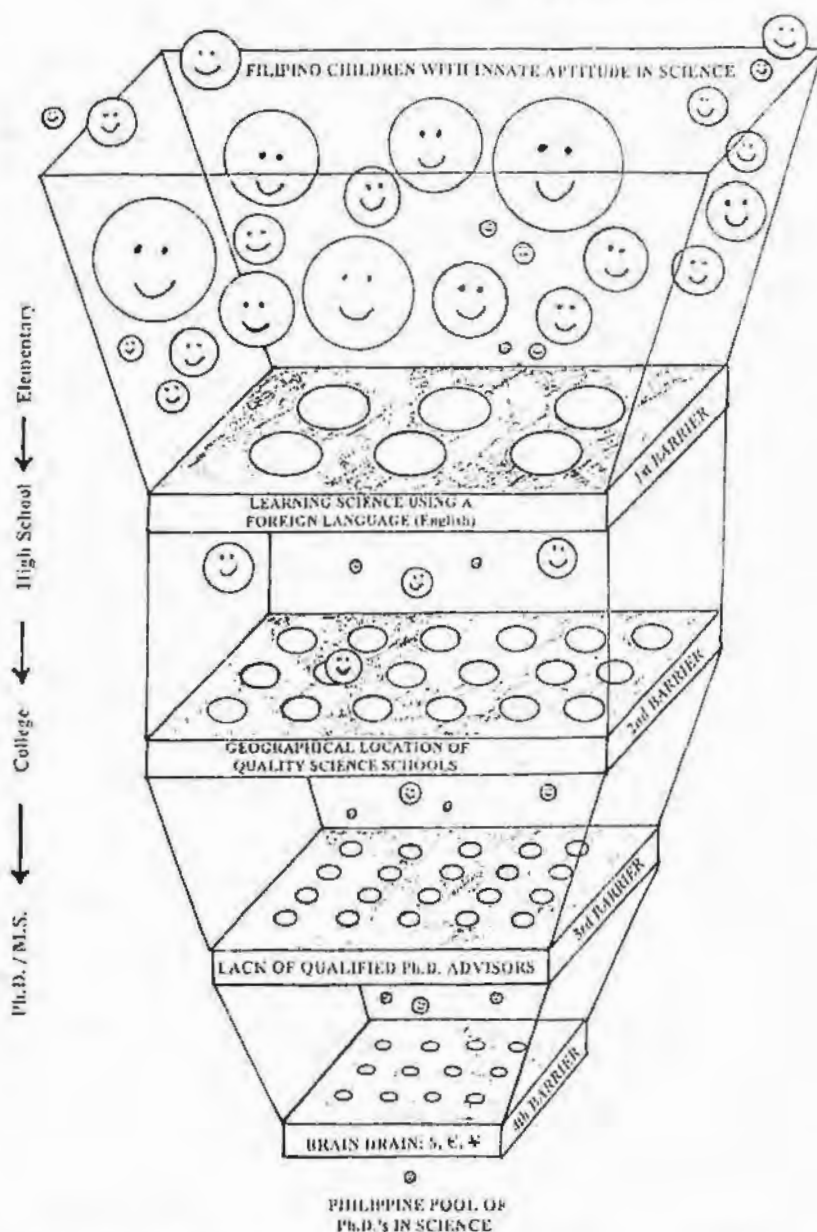


Figure 1. Factors that impede scientific manpower development in the philippines.

Solving the four-barrier problem can, indeed, be mind-boggling. Granting that we are able to solve barriers (1) to (3), barrier number (4) remains to be a threat that undermines all efforts to develop and maintain a decent scientific manpower. The most devastating factor is the exodus of talents to other countries, or brain drain. The dreaded brain drain also exacerbates the other barriers since it naturally leads to a lack of qualified Ph.D. research advisors, and depletes the qualified personnel needed to man geographically strategic educational centers of excellence.

Breaking the Barriers

The first problem – the language barrier belongs to Basic Education, and can be handled by the Dynamic Learning strategies advocated in Part I of this paper [7]. The three remaining barriers are interconnected. This implies that a solution for one also partially solves the others. Consider, for instance, the dreaded brain drain phenomenon because it is capable of generating the other barriers. Brain drain is like a continuous leak in the bucket that we are furiously trying to fill with water. There are, however, two ways to approach this problem. One involves patching up the hole, but the hole can recur if the pressures involved are too high. The second way is by redirecting water that has leaked out back into the bucket. The brain-drain problem is complex in view of its economic, political, and global features. Given our poor economic scenario, is there a way of partially neutralizing the effects of brain drain that at the same time partly breaks the other identified barriers? We think there is, and the solution that partially breaks all barriers has, in fact, concretely been tried and tested (see section 3), but so far, only on a very small scale and mainly through private initiative. The solution is not that expensive, and it actually promotes a *reverse* brain drain, or *brain gain* (redirecting water back into the bucket), where noted scientists, of foreign or Filipino origin, can do first-rate research in our country. A cost-effective solution that has been proven to be a workable model (see, e.g., sections 3 and 4) is contained in the following recommendation:

The establishment of a government-supported institute(s) dedicated to fundamental research and characterized by the following:

1. A scientific staff of 3 to 5 Ph.D.s of proven research capability, augmented by Visiting Scientists whose appointments can range from 3 weeks to 3 months;
2. The institute accepts Ph.D. students for thesis advising;
3. The institute should be geographically located so as to serve the dual purpose of: (a) being accessible to untapped young talents at the grassroots level, and (b) being attractive enough for foreign scientists;
4. The institute should endeavor to obtain private and foreign funding to allow a wider range of scientific activities.

From the economic point of view, a team which can do theoretical research work can be formed immediately. A theory group also has a significantly high ratio of scientific gain to cost of funding. Depending on the budget, a team for experimental work can then follow. The emphasis on theoretical work is motivated by the fact that one can do internationally competitive research with essentially just paper and pen, plus a few books. It has been observed that similarly minded paper and pen first-rate scientists from advanced countries do not really mind visiting a place with minimal infrastructure. If the site is a major tourist destination it, of course, becomes an added advantage. With local Ph.D. students rubbing shoulders with internationally noted scientists, first-rate science can slowly take root in our country, and a brain gain takes place.

At present, there are several educational institutions for the basic sciences within the University of the Philippines (UP) system, such as the National Institute of Physics and the Marine Science Institute in Diliman. High caliber science has been slowly emanating from these institutes, but not fast enough and plenty enough, considering that we are a country of 70 million people. For UP as a whole, its lack of research output is partly reflected by the fact that our premier university only ranks number 48 in the Asia's Best Universities 2000 ranking [2]. These science institutes of UP do suffer from a lack of qualified and willing Ph.D. thesis advisors, and most of the productive researchers are saddled with teaching and administrative duties which come with a university set-up.

A research institute's independence from traditional state-supported or private universities in the country allows for greater freedom and minimal bureaucracy. From its neutral position, it could contribute more effectively in upgrading standards of advanced science instruction in various educational institutions in the area through linkages, workshops, and research training sandwich programs. Moreover, local Ph.D.s from various universities can come and interact under the Visiting Scientist program of the institute. Creativity, independence of thinking, as well as the cross-fertilization of ideas required in scientific inquiry are enhanced in this setting. Once established, a regular monitoring of the research institute is advisable. The institute's progress can be measured based on: (1) its number of publications in international journals; (2) its international linkages and ability to attract first-rate scientists from the international scientific community, and (3) its ability to obtain grants from local and foreign sources.

Although having strategically located research institutes devoted to fundamental research is a tried-and-tested pattern in advanced countries (see section 4 on the Max Planck Institutes of Germany), one can also cite the Tata Institute of Fundamental Research (TIFR), a success story in Mumbai, India. This world-renowned institute established in 1945 has served as a magnet for world-class Indian and foreign scientists to work and do research in Mumbai. The TIFR serves as a model where brain drain can partially be reversed. The Institute has several field stations and research facilities in

different parts of the country. At present, the TIFR has 400 scientists grouped into three major schools namely, the School of Mathematics (which has a center at Bangalore), the School of Natural Sciences, and the School of Technology and Computer Science. Recently, the National Centre for Biological Sciences in Bangalore, India, was created as part of TIFR with the mandate to carry out basic research in the frontier areas of biology.

The Research Center for Theoretical Physics in Jagna, Bohol

In view of the fact that each country possesses a unique social, economic, and political environment, a workable model in other countries does not necessarily imply that the model would also work in the Philippines. It is therefore instructive to cite a test case, within the Philippine context, of a research center and its efforts to promote brain gain. The small privately run Research Center for Theoretical Physics (RCTP) in Jagna, Bohol, for example, has managed to attract first-rate scientists which include G. 't Hooft (*1999 Nobel Prize in Physics*), H. Araki (*2003 Henri Poincare Prize*), F. Wilczek (*Editor-in-Chief, Annals of Physics*), J. Klauder (*former Editor-in-Chief, Journal of Mathematical Physics*), C. DeWitt-Morette (*Founder, Les Houches Summer Schools*), T. Hida (*inventor of the Hida calculus*), H. Ezawa (*former President, Japan Physical Society*), and many authors of successful advanced physics books such as, L. Schulman, F. Wiegand, L. Streit, and G. Roepstorff, among others. During the visits of these scientists, which ranged from four days to three weeks, the RCTP made it a point to invite young Filipino students to benefit from their stay. The students came from the University of the Philippines, De La Salle University, and the MSU-Iligan Institute of Technology.

Since its creation in 1992, the RCTP has served as a tropical venue for small meetings, discussions or simple private retreats to gain new perspectives and ideas. With its informal and relaxed atmosphere, it has served as a place where interfaces between various areas of physics could be explored. The RCTP staff has also been advising M.S. and Ph.D. students from the National Institute of Physics, University of the Philippines, for their thesis work. Presently, the RCTP has a 5-year Memorandum of Agreement with the MSU-Iligan Institute of Technology designed to assist its newly instituted Ph.D. (Physics) program. Several of the MSU-IIT physics graduate students have been visiting the RCTP, especially when foreign scientists are around. Moreover to alleviate the lack of qualified Ph.D.s in nearby educational centers, the RCTP allows its staff to have a Visiting Lecturer arrangement with physics departments of neighboring universities for selected advanced topics. This is the case with MSU-IIT, and possibly by June 2004, with the physics department of the University of San Carlos, Cebu City. In line with its objectives, the RCTP has organized three international workshops with local and foreign funding as follows:

- 1st Jagna International Workshop on Advances in Theoretical Physics, 4–7 January 1995. *Major Sponsors:* Department of Science and Technology, International Centre for Theoretical Physics (Italy), Alexander von Humboldt-Stiftung (Germany), UNESCO-ROSTSEA (Jakarta), National Research Council of the Philippines, *Samahang Pisika ng Pilipinas*, Philippine Convention and Visitors Corporation.
- 2nd Jagna International Workshop: Mathematical Methods of Quantum Physics, 4–8 January 1998. *Major Sponsors:* Department of Science and Technology, Abdus Salam International Centre for Theoretical Physics (Italy), Alexander von Humboldt-Stiftung (Germany), Philippine Charity Sweepstakes Office, De La Salle University, Philippine Convention and Visitors Corporation.
- 3rd Jagna International Workshop: Functional Integrals in Stochastic and Quantum Dynamics, 4–17 January 2001. *Major Sponsors:* Department of Science and Technology, Alexander von Humboldt-Stiftung (with support from the Federal Ministry for Education, Science, Research & Technology of Germany), Abdus Salam International Centre for Theoretical Physics (Italy).

Aside from the international support it received during these Workshops, the RCTP also obtained a three-year (1999–2002) DM 60,000 research project grant from Germany's Federal Ministry for Education, Science, Research & Technology administered by the Alexander von Humboldt-Stiftung.

Although the RCTP is in a non-urban area, the island province of Bohol is strategically located and is the present number one tourist destination in the Philippines. It has an airport and several seaports linking it to the international gateway cities of Cebu and Manila. The town of Jagna, from where Camiguin island can be seen, has a port which connects it to several neighboring provinces in the Visayas and Mindanao by sea. Guests could thus easily go to many places of interest in the Philippines and the rest of the Asia-Pacific area.

Being privately run and lacking a regular budget the RCTP, nonetheless, has managed to induce a brain gain. With its strategic location, it has also been able to assist the physics department of the MSU-Iligan Institute of Technology. The MSU-IIT has been identified as an educational Center-of-Excellence in physics by virtue of CHED Resolution no. 021-98 – the only one outside of Luzon. The RCTP has also conducted workshops for high school and tertiary science and math teachers. One of these, for example, was the five-week (April 17–May 19, 1995) “Seminar in Nuclear Science for High School Teachers,” organized in cooperation with the Philippine Nuclear Research Institute. Such modest gains, however, could still be enhanced with the availability of more regular government support.

The Max Planck Research Institutes

How should research institutes for basic research in the Philippines look like several decades from now? An interesting model would be the Max Planck Research Institutes of Germany, since Germany has a population comparable to that of the Philippines. Adjustments, however, have to be made since Germany is one of the wealthiest countries in the world. The Max Planck Society for the Advancement of Science is an independent, non-profit research organization. It runs research institutes for basic research and takes up new and innovative research areas that German universities are not in a position to accommodate or deal with adequately [3]. The interdisciplinary research areas they tackle often do not fit into the university organization. Max Planck Institutes, however, complement the work done at German universities. Some of the Max Planck Institutes perform service functions for research performed at universities by providing equipment and facilities, such as telescopes, large-scale equipment, and specialized libraries.

The Max Planck Society is not a government institution although it is funded to a large extent by the federal and state governments of Germany. Founded on February 26, 1948, the Society had initially 25 research institutes. By June 1960, the Max Planck Society had 40 institutes and research facilities. This grew to 52 institutes in 1966. Today, there are about 80 autonomous research institutes of the Max Planck Society primarily devoted to fundamental research.

The sizes of the research institutes can vary. For instance, the Max Planck Institute for Gravitational Physics, founded in 1995, had an initial staff of about 10 scientists. Today it has approximately 30 full-time scientists, supplemented by 150 Visiting Scientists each year. At this institute, a number of diploma and Ph.D. students are also supervised. The Max Planck Institute for Biochemistry, on the other hand, had 792 employees in 1998 (including people funded by 3rd parties) of which 475 were scientists (including junior and guest scientists) and 207 technical staff.

The Max Planck Research Institutes are geographically spread out all over Germany. We list below *some* of the Max Planck Institutes and their location.

1. Max Planck Institute for Physics (*Muenchen*)
2. Max Planck Institute for Extraterrestrial Physics (*Muenchen*)
3. Max Planck Institute for Astrophysics (*Garching*)
4. Max Planck Institute for Quantum Optics (*Garching*)
5. Max Planck Institute for Plasma Physics (*Garching*)
6. Max Planck Institute for Biochemistry (*Martinsried*)
7. Max Planck Institute for Neurobiology (*Martinsried*)
8. Max Planck Institute for Biological Cybernetics (*Tuebingen*)
9. Max Planck Institute for Solid State Research (*Stuttgart*)
10. Max Planck Institute for Nuclear Physics (*Heidelberg*)

11. Max Planck Institute for Astronomy (*Heidelberg*)
12. Max Planck Institute for Medical Research (*Heidelberg*)
13. Max Planck Institute for Informatics (*Saarbruecken*)
14. Max Planck Institute for Computer Science (*Saarbruecken*)
15. Max Planck Institute for Chemistry (*Mainz*)
16. Max Planck Institute for Polymer Research (*Mainz*)
17. Max Planck Institute for Biophysics (*Frankfurt am Main*)
18. Max Planck Institute for Brain Research (*Frankfurt am Main*)
19. Max Planck Institute for Radioastronomy (*Bonn*)
20. Max Planck Institute for Mathematics (*Bonn*)
21. Max Planck Institute for Terrestrial Microbiology (*Marburg*)
22. Max Planck Institute for Biophysical Chemistry (*Goettingen*)
23. Max Planck Institute for Microstructure Physics (*Halle*)
24. Max Planck Institute for Mathematics in the Sciences (*Leipzig*)
25. Max Planck Institute of Molecular Cell Biology and Genetics (*Dresden*)
26. Max Planck Institute for Molecular Genetics (*Berlin*)
27. Max Planck Institute for Gravitational Physics (*Golm*)
28. Max Planck Institute of Molecular Plant Physiology (*Golm*)
29. Max Planck Institute for Dynamics of Complex Technical Systems (*Magdeburg*)
30. Max Planck Institute for Meteorology (*Hamburg*)

Need for a Concerted Effort

Ideally, to be globally competitive in science, the Philippines could aim to have the same number of research institutes as the Max Planck Society of Germany. The Philippine society, however, faces barriers that hinder the growth of an internationally competitive scientific community. Brain drain has been the most telling of all these barriers, and the situation can become worse. There is a growing trend in advanced countries where lesser and lesser university students take up science and technology as a career. This trend, coupled with the tendency of advanced countries to decrease in population, means that they would become more aggressive in recruiting up-and-coming Ph.D.'s in science from Third World countries. This, in fact, has already started in Germany where attractive long-term research positions are offered to young talented Ph.D.s in science from all over the world. Germany has the resources and the research institutes to absorb these young scientists.

The Philippines has to take real and immediate steps if it does not want to continually lag behind in the race for new scientific knowledge and its high technology applications. One concrete action to partially reverse brain drain is to establish government-supported internationally competitive institutes devoted to fundamental research, separate from traditional university structures. Experience from the private

sector, such as the RCTP, has proven that a research institute for fundamental research can promote brain gain. Research in theoretical science does not cost much, and the scientific gain to cost ratio is high. When additional budget becomes available, experimental research sections can then be added to the research institutes.

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TALENT AND INNOVATIVENESS TO MEET THE CHALLENGE OF GLOBAL STANDARDS IN SCIENTIFIC PRODUCTIVITY

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Abstract

Universities particularly their science and engineering graduate programs, are primary producers of precious intellectual capital. We examine the generation of intellectual capital in the Philippines in terms of the number of PhD and MS graduates produced in the natural sciences and the number of scientific papers authored by scientists with Philippine-based affiliations. We utilize the 21 year-graduation data (from school year 1983-84 to 2003-2004) of the College of Science, University of the Philippines and the 11-year publication output (1993 - 2003) of Philippine-based scientists in peer-reviewed journals that are indexed by the Institute of Scientific Information. The Philippine performance is compared with those of other ASEAN countries for the same period of time. The findings are discussed from the perspective of Schumpeter's theory of business cycles. Our analysis reveals that the most serious challenge facing capital generation in the Philippines is the lack of quality graduate programs for producing competent PhD graduates in the sciences and engineering. Local graduate programs are vital in retaining young talented BS graduates who are likely to go to foreign universities for lack of other viable options.

Key words: scientific productivity, innovativeness, intellectual capital

Introduction

Science seeks to make sense of the physical world and the immutable aim of scientific research is to extend our knowledge of the physical, biological, or social world beyond what is already known. The untiring effort towards a better understanding could be due to the innate desire of human beings to overcome ignorance and to rise above helplessness. It could also be motivated by childlike curiosity or driven by personal desire to improve oneself. Regardless of motives, the expansion of scientific knowledge is bound to enrich human society either materially, spiritually or both.

Science is essential for the continued progress of human societies especially those in developing countries like the Philippines. Among the various human endeavors, the scientific enterprise is the most likely to provide the best possible solutions to problems that are caused by increasing human population, dwindling natural resources, and human inefficiency and incompetence. So far, the scientific enterprise has been highly successful due to the uncompromising practice of honesty, openness, collegiality, scepticism, and fairness by scientists themselves [1]. It seems logical to extrapolate that significant benefits are gained if those from other occupations in life are also able to practice a similar code of conduct and proper behavior.

A country with an established tradition in science and engineering also tend to be economically robust. In 1939, the Austrian economist Joseph Schumpeter argued that a normal, healthy economy is constantly interrupted by technological innovation and that business cycles are unique and driven by entirely different clusters of industries [2, 3]. Over time, the durations of economic waves are shortening, from 50 - 60 years during the first wave (1785 ~ 1845) to less than 30 years in the so-called fifth wave (1990 -) which has been largely fueled by information and communications technology. Innovation which is the application of new knowledge that is gained from scientific research and development, powers the birth of new and better technologies. The cycles of innovation are getting shorter because our knowledge of the physical world has become more accurate and reliable as a result of sustained scientific research and development over the years.

It is difficult to predict the *killer* technologies that will jump-start the next economic wave. However, it is safe to argue that the next killer technology will result from long-term investments in scientific research and development. To partake in the next economic wave and compete in a global market that is increasingly becoming more capricious in taste and needs, a country (or a company for that matter) must have the wherewithal to generate intellectual capital using resources that are within its control and regulation. Huge amounts of intellectual capital are needed to enable a country to place bets simultaneously on many promising fields in nanoscience, materials science, molecular biology and biotechnology, energy, and information technology – areas where the next technology catalyst is most likely to emerge according to pundits [4].

Here, we discuss the generation of intellectual capital in the Philippines in terms of the number of PhD and MS graduates that are produced in the natural sciences and the number of scientific papers authored by scientists with Philippine-based affiliations. We employ the twenty-one year-graduation data (from school year 1983-84 to SY 2003-2004) of the College of Science, University of the Philippines in Diliman, Quezon City. We also examine the eleven year performance (1993 - 2003) of Philippine-based scientists in terms of publications in peer-reviewed journals that are indexed by the Institute of Scientific Information (ISI). The performance is compared with those of other ASEAN countries for the same period of time. We also present the R&D funding profile (1989-2002) of the Philippine Council for Advance Science and Technology Research and Development (PCASTRD) of the Department of Science and Technology.

Universities particularly their science and engineering graduate programs, are primary generators of intellectual capital. The production of PhD and MS graduates is a vital indicator of a country's capability to generate intellectual wealth since graduate degrees are research degrees. A PhD degree is awarded to someone who has contributed to the body of scientific knowledge in his or her particular area of specialization.

The UP College of Science is the most important producer of PhD and MS graduates in the natural sciences in the Philippines today [5]. Among its affiliated degree-granting units are national centers in geological sciences (National Institute of Geological Sciences), marine sciences (Marine Science Institute), molecular biology and biotechnology (National Institute of Molecular Biology and Biotechnology) and physics (National Institute of Physics).

Publication of results in a peer-reviewed scientific journal often indicates the successful completion of a research project. The peer-review process is an essential aspect of self-regulation in the science community. It has been largely effective in ensuring that only scientific reports that are original, novel, scientifically valid and important are disseminated not only to scientists but also to the general public. The ISI operates and maintains a database of papers that have been published in scientific journals around the world. To be considered in the ISI database, a scientific journal has to satisfy a number of publication conditions [6].

The PCASTRD offers research funding in the areas of biotechnology, electronics, instrumentation and controls, information technology, materials science, photonics, and space technology application [7]. It is also a major provider of local graduate degree scholarships in the sciences, mathematics and engineering.

Production of MS and PhD Graduates

The College of Science (CS) was established in 1983. It consists of ten degree-granting academic units which offer the following graduate programs: (1) Institute of Biology (MS Biology, MS Botany, MS Microbiology, MS Zoology, PhD Biology, PhD

Botany, PhD Zoology), Institute of Chemistry (MS Chemistry, PhD Chemistry), (3) National Institute of Geological Sciences (MS Geology, PhD Geology), (4) Marine Science Institute (MS Marine Biology, MS Marine Science, PhD Marine Science), (5) Department of Mathematics (MS Applied Mathematics, MS Mathematics, PhD Mathematics), (6) Department of Meteorology and Oceanography (MS Meteorology, MS Oceanography, PhD Meteorology), (7) National Institute of Physics (MS Physics, PhD Physics), (8) National Institute of Molecular Biology and Biotechnology (MS Molecular Biology, PhD Molecular Biology), (9) Environmental Science Program (MS Environmental Science, PhD Environmental Science), and (10) Materials Science and Engineering Program (MS Materials Science, PhD Materials Science).

The National Institute of Molecular Biology and Biotechnology evolved from the Molecular Biology and Biotechnology Program. In 2003, the Institute of Environmental Science and Meteorology was established out of the merger of the Department of Meteorology and Oceanography and the Environmental Science Program. The Materials Science and Engineering Program is a joint effort between the College of Science and the UP College of Engineering.

Figure 1 shows the number of PhD graduates produced by the various CS units from SY 1983-1984 to SY 2003-2004 [8]. In twenty-one academic years from SY 1983-84 to SY 2003-2004, the College of Science graduated a total of 256 PhDs. An annual average of 12.2 PhD graduates is produced by the College. The Institute of Biology produced the largest number at seventy (or 3.3 graduates per year) followed by the Department of Mathematics with forty-five (2.1 graduates per year) and the defunct Department of Meteorology and Oceanography with 41 (2 graduates per year). The National Institute of Physics yielded an average of 1.7 PhD graduates per year. The Materials Science and Engineering Program has not produced any since its inception.

Figure 1 reveals that PhD production is not increasing at a steady rate. Peaks are observed in SY 1989-90 and SY 1997-98 indicating a possible cycle with a 9-year period. The National Institute of Physics produced 58.8% of its PhD graduates in the last seven years of the time series.

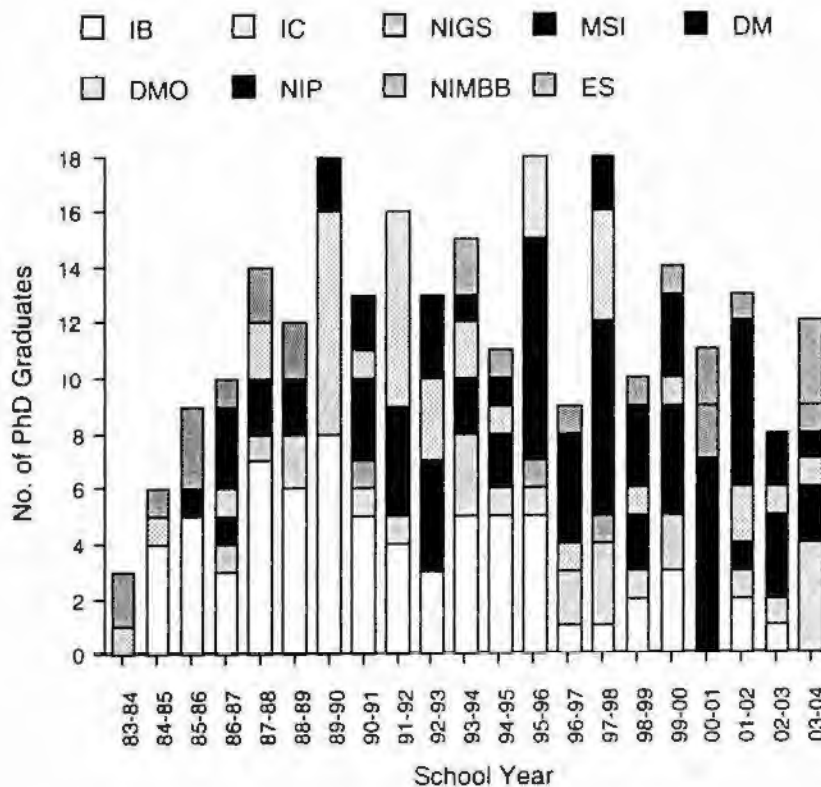


Figure 1. Number of PhD graduates produced by CS units over a 20-year period. Legend: Institute of Biology (IB), Institute of Chemistry (IC), National Institute of Geological Sciences (NIGS), Marine Science Institute (MSI), Dept of Mathematics (DM), Dept of Meteorology and Oceanography (DMO), National Institute of Physics (NIP), National Institute of Molecular Biology and Biotechnology (NIMBB), Environmental Science Program (ESP), and Materials Science and Engineering Program (MSEP).

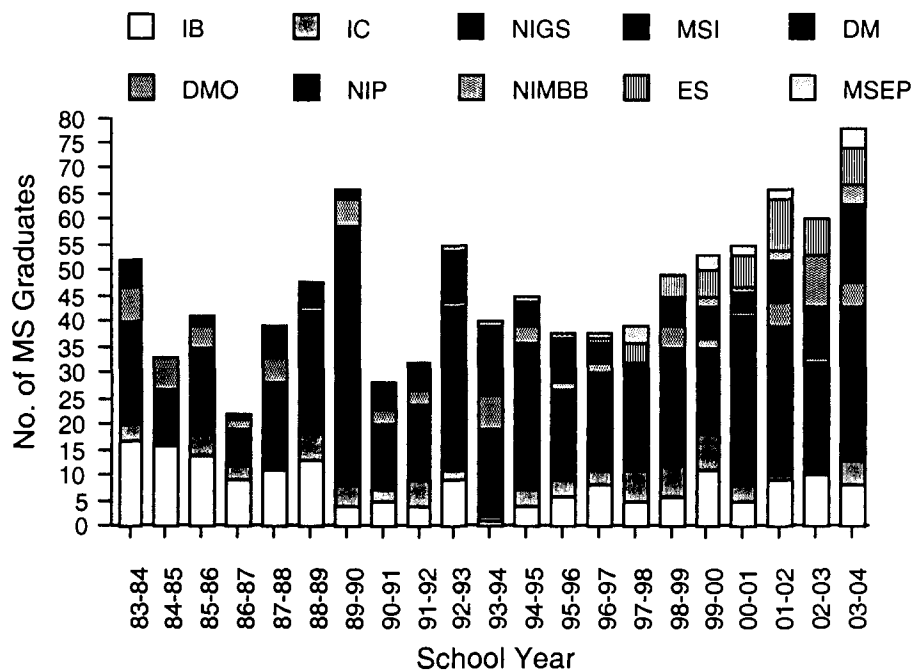


Figure 2. Number of MS graduates produced by CS units over a 20-year period.

Figure 2 plots the number of MS graduates produced by CS within the same 20-year period. A total of 977 students received their MS degrees indicating an annual average of 46.5 graduates per year or 5.2 graduates per year per unit. The Department of Mathematics produced the highest number of MS graduates at 318 (or 15.1 graduates per year) followed by the Institute of Biology with 175 (8.3 graduates per year). The National Institute of Physics yields an average of 5.8 MS graduates per year. The National Institute of Molecular Biology and Biotechnology graduated a total of twenty-one students over the same period.

Unlike the PhD graduation profile, an increasing trend in the number of MS graduates is detected in Fig 2 – about 28% of the MS graduates have been produced in the last four academic years from SY 2000-2001 to SY 2003-2004.

ISI Publications

Figure 3 plots the annual number of ISI publications emanating from Malaysia, Philippines, Singapore and Thailand from 1993 to 2003 [9]. A linear fit reveals a slope value (proportional to increase rate of ISI publications per year) of 373 ppy, 139.33 ppy, 78.436 ppy and 21.11 ppy (publications per year) for Singapore, Thailand, Malaysia and Philippines, respectively. The ISI publication profile of Indonesia (not shown in Fig 3) yields a slope of 31.7 ppy.

The ISI publication rate of our ASEAN neighbors clearly shows an increasing trend unlike the Philippines whose annual output has never exceeded 500 within the 11-year period. In 1993, Thailand with 412, had 2.1 times the number of ISI publications than the Philippines. In 2003, it had 2102 ISI publications representing 4.49 times the number published by Philippine-based researchers.

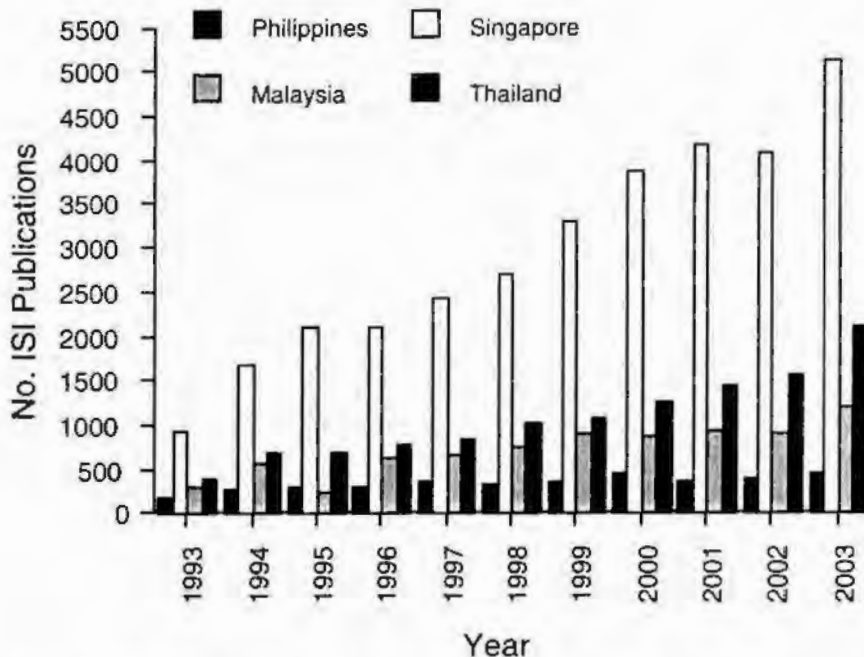


Figure 3. Annual number of ISI publications emanating from Malaysia, Philippines, Singapore and Thailand within an 11-year period.

Funding for Scientific Research

Figure 4 presents the financial support that was given annually by PCASTRD to research projects from 1989 to 2002 [10]. Also shown are portions that were awarded to researchers in materials science and photonics sectors. Most of these researchers belong to the Philippine physics community. Within a 14-year period, the PCASTRD released a total amount of PhP164,909,776.42 in research grants of which PhP 67,340,254.11 (40.83%) and PhP 15,524,343.04 (9.41%) went to the materials science and photonics sectors, respectively. The biotechnology sector received 27.45% of the total financial disbursements for research and development.

The amount of money that has been spent for research and development did not increase steadily in nominal terms. The trend becomes even more dismal when we factor in the effects of inflation and the changes in the foreign exchange rate between the Philippine peso and the US dollar. Between January 1990 (USD = PhP24.46) and December 2002 (USD = PhP 53.52), the Philippine peso depreciated by almost 120% against the US dollar. For Filipino researchers the effect is doubly devastating because all precision instruments and devices and research-grade components have to be acquired from abroad.

Discussion

Based on data that have been accumulated over a 21 year-period, the ability of the College of Science to produce well-trained PhD graduates is far from desirable. The annual average production rate of 1.3 PhD graduates per unit is below the performance that can be expected of a college where the average number of full professors per academic unit is 7.8 [11]. A PhD student needs a minimum of three years to complete his or her academic requirements (after earning his or her MS degree). Even if we factor that in, still the average production rate remains low because associate professors and assistant professors are allowed by the University of the Philippines to supervise PhD students on their own.

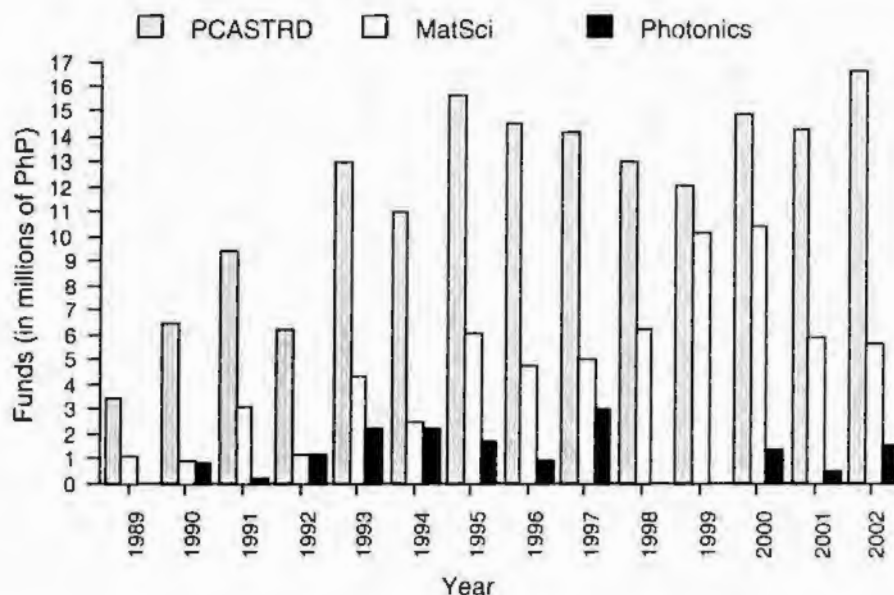


Figure 4. Annual financial support (grants-in-aid) given by PCASTRD. Also shown are portions given to projects in Materials Science and Photonics.

Only the Marine Science Institute and the National Institute of Physics, require a PhD student to publish at least a part of his or her dissertation research in an ISI-indexed journal. To help ensure world-class training for its PhD students, the College of Science needs to adopt the ISI publication requirement in all of its PhD graduate programs. During its initial implementation, the ISI publication requirement is expected to reduce (further) the number of PhD students who will earn their degrees but this is only a temporary setback that is worth paying for to promote genuine scientific excellence in the long term.

Enlarging the pool of competent faculty supervisors who are willing to train PhD students is the most serious challenge facing the College of Science today. To be up to the challenge, a faculty must have the necessary technical competence and the good sense to mentor young scientists and make them achieve their full potential. In a society where scientific tradition is not yet rooted, the scarcity of competent mentors only helps to perpetuate a culture that is incapable of distinguishing and celebrating scientific excellence. A society with such a culture tends to rationalize scientific mediocrity and believes in the mistaken notion that excellence is a matter of patronage or connections.

In 1998, Taiwan produced 907 PhD graduates in the sciences and engineering [12]. In the same year, the Philippines with a population that is almost four times larger, graduated an order of magnitude less. Japan and Korea produced 6,575 and 2,484 PhD graduates respectively, in the said given year.

The lack of notable increase in the number of ISI publications from the Philippines can be attributed to a number of factors. It could be due to a lack of an effective (and dynamic) national policy on science and technology or to an ambivalent implementation of an otherwise coherent plan including insufficient and sputtering financial support (from both the public and private sectors) for scientific research and development. It could also be caused by a local science community that is incapable of (and disinterested in) competing with the rest of the world in the generation of new scientific knowledge. The ISI publication performance is a function of the number of researchers engaged in research and development. In 2001, the number of researchers per million of inhabitants in Japan, Korea, US and Singapore were 5321, 2880, 4099, and 4052, respectively [13]. In 2001, the density for the Philippines was 157 [14].

In 1999, Italy allocated the lowest percentage of gross domestic product (GDP) for research and development at slightly above 1% among the G7 countries. Japan spent the highest at approximately 3%. In the same year, Taiwan spent 2.05% of GDP rising to 2.16% in 2001 [15]. In 2002, Taiwan-based researchers produced 10,831 publications in ISI-indexed journal - Taiwan was the 18th most published country in the world in the said year. In 1992, the Philippines only spent 0.22% of its GDP and in 2001, it even spent lower at 0.15%. In 2001, Japan and South Korea devoted 3.09% and 2.96% of their GDP respectively on research and development. In 1992, these countries used 2.86% and 2.1%, respectively [16]. Singapore spent 1.13% of its GDP for the same purpose in 1995 rising to 2.11% in 2001.

Whether we like it or not, counting the number of ISI publications is a widely-accepted benchmark for assessing the performance of researchers. Of course, there are finer points of excellence like publishing in an ISI journal with high journal impact factors (e.g. *Nature* or *Science*) or the number of citations (by others) received from previous publications. These details however, are employed to distinguish excellence from the merely good.

Conclusion

We have discussed the capability of the Philippines to generate intellectual capital in the form of the number of PhD and MS graduates produced in the natural sciences and mathematics over a 21-year period. We have also studied the number of ISI papers published by researchers with Philippine-based affiliations from 1993-2003.

Our data indicate a performance that is wanting in both measures. In the competitive index released by the World Economic Forum for 2003-2004, the Philippines occupied the 64th position – a rank that is lower than its Asian neighbors: Singapore

(8), Taiwan (16), Malaysia (26), China (46), Thailand (31), Vietnam (50) and Indonesia (60) [17]. Direct investments flow faster towards countries that are perceived to be more competitive.

Our scientific performance is not significant enough because of the low number of Filipinos who are engaged in scientific R & D. The lack of capable PhD supervisors prevents our country from producing enough PhD graduates to make it competitive and attractive to direct investment in the technology sector of the industry. It also makes our domestic graduate programs unappealing to young BS graduates who have no other option but to leave the country.

The key to enhancing the capability of the Philippines to generate intellectual capital is the development of world-class graduate programs in local universities. Sending BS graduates to earn their PhD degrees abroad is not the solution. Supporting locally-trained PhD graduates to do postdoctoral research in top foreign research laboratories, is.

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