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Heeding the Voices of the Past: Experiencing and Learning its Lessons in Knowledge Economy

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ABSTRACT
This research proposes a different conception of knowledge economy by examining knowledge as a philosophical term and by arguing against Peter Drucker's conception of knowledge economy. It primarily seeks to address the problem on how the Philippine education responds to the challenge posed by knowledge economy as contrastively conceived here. The research explains how the performance of Philippine education in the past decades, though demonstrating quantitative growth particularly during the 60s and 70s, failed to produce a real qualitative growth adequate to impact on the Philippine knowledge economy. It also substantiates the writer's claim that there are types of knowledge economy, and that of the Philippines exemplifies a particular type. Though it aims to reach the type of knowledge of economy that characterized those countries in the First World, the Philippine education has to harness first the potential of its present type of knowledge economy by improving the curriculum and teacher education as well as by focusing on BPO, Service-Oriented, and low-end technological courses. This paper ends by proposing a new curriculum for its basic education, secondary education, and tertiary education. It views additional two years of education not as one of the options anymore but the only option to address the present woes in education that are slowly becoming irreversible.

Introduction

Though having food keeps people alive for a short length of time, it is eventually having knowledge in obtaining and producing food that keeps people living long enough to organize themselves into a community, and long enough to evolve for themselves a civilization. Thus, it is knowledge that brings progress to the way of life. Through it people can build a city of stones and metals. Through it they can redesign the harsh face of nature, making it subservient to meet the needs and comfort of life. Furthermore, through it they survive adversity of various forms – war, famine, natural disaster, and pestilence.

It is the growth of knowledge that gives people the privilege to be the steward of earth. King Solomon of the old days knew knowledge had advantage over material riches. It cannot be destroyed. Like energy, it can be renewed through use as people discovered better and newer ways of its dispensation. Houghton (2000, p.12) appreciates the value of knowledge because, for him, consumption only replenishes its value - supplying endless and boundless benefits and enjoyment to its patrons.

To call an economy shaped, harnessed, and produced by the use and growth of knowledge "knowledge economy" is like naming something that has been around long before the birth of the namer. OECD defines knowledge economy as "the economy based on the production, distribution, and application of knowledge." The role of knowledge in economy has fascinated scholars, driving them to formulate a wealth of theories and to write dense volume of studies.

They understand how knowledge has yielded significant impact on education, organization, and innovation (Houghton and Sheenan, 2000, p.9).

Certain patterns are identified as to the creation, systematization, distillation, and diffusion of knowledge. First, knowledge has been codified, networked, and digitalized as information. Second, knowledge has been increasingly commodified. Third, learning, a process producing knowledge, has been examined and recognized to be multifaceted, and these aspects are as follows: learning by thinking, learning by using, and learning by interacting. Fourth, learning organizations, which create knowledge, are now known to evolve into network organizations.

Philippine Education for the 21st Century (1999, p.1) underscores the opening of international markets, the cultivating of resources, and the advancement of technology as catalysts for economic progress and modernization. These conditions may result in unregulated trade and industrial expansion (globalization) among countries, deepening and widening the wedge that divides affluent from impoverished countries. Competition that spurs globalization favors countries that are technologically and educationally equipped. Japan, South Korea, Taiwan, and China have understood this, so their governments invest huge money in scientific and technological research (Ibid. p.49). For the Philippines to compete aggressively in global markets, similar technological competence has to be attained (Ibid. p.2).

Those scholars who keep a keen eye on how education cogently affects economy have noted this already. Reflecting from 1996 OECD report, Padolina (2005, p.40) is convinced that "education will be the center of the knowledge-based

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economy, and the learning the tool of individual and organizational advancement." However, to think of the Philippine education as capable of churning out a cadre of scientists and high-end knowledge-workers, just like its giant industrial neighbors, U.S., and highly technological Western countries, may be an overstatement. The reality is, the country has knowledge economy, but it still is staggering on its feet as it still lacks that critical number of elite intellectuals who can push the weight of the country out its it present economic woes into computer and robot age (Ibid. p.42).

The conception of knowledge economy has to be understood within the context of economically struggling countries like the Philippines. The massive-engaged application of computer technology, space technology, biotechnology, and robotic technology to various spheres and activities of economy – the hi-end notion of knowledge economy that is – is still to occur several years from now. In line with this, Padolina (2005, p.42), in fact, notes that "the present number of Filipinos who can significantly contribute to our economic recovery are just too few and far between in this archipelago." With present woes they faced – under-funded, under-staffed (both of qualification and talent), and mismanaged, it is too much to ask from Philippine institutions of learning to support such high-tech postulation of knowledge economy. Added to this, these institutions have many problems, but only have few options to solve them.

Knowledge is now acknowledged of various types. It can be conceptual, pure theoretical, applied scientific, and cultural types. Under conceptual knowledge is a body of principles and terminologies designed to describe as well as to provide methodological tools to examine certain phenomena. Theoretical knowledge consists of abstracted statements that are based on systematic, high ordered, and fact-based reasoning. Applied scientific knowledge is the unlimited and furious transformation of conceptual and pure theoretical knowledge to improve the quality of modern life. Cultural knowledge strengthens the moral, social, and spiritual fiber of a people. This knowledge comes from a confluence of beliefs, assumptions, and values. With certain countries enjoying a good headstart and bountiful resources to create and maintain a progressive knowledge economy, economies like that of the Philippines must exploit whatever resources and advantages they have.

Statement of the Problem

Knowledge, examined in its various forms, is now being held as the most potent driving force of economy. It is intricately conflated into economy, which validates its reproduction and distribution. To understand this relation between knowledge and economy, this problem is posed: How can Philippine education respond to the challenge knowledge economy poses? This problem has to be addressed in the context of the present state of Philippine education. Below are the specific questions addressed in this research:

1. How had the Philippine education performed during the last decades before 2010?
2. What is the potential of the Philippine knowledge economy?
3. How can education be conceived in terms the needs of knowledge economy?
4. What program of actions can be implemented in the Philippine education to realize the potential of a more advanced knowledge economy?

Related Literature and Studies

High school education gets most attention every time the issue of the quality of education is raised. Parents gauge how the education of their children has performed in terms of either of the following: how their high school alma mater prepared them for work after graduation; how they met college academic requirements; or whether they would be admitted to UP (Termulo, 2005). Nonetheless, because of mismanagement, public high schools have failed to deliver (Philippine Education for the 21st Century, 1999, p.5).

Access to public education for most children is elusive because of the defective admission system. Philippine Education for the 21st Century (1999, p.6) blames the primary education on the deterioration of high school education. Bernardo (2005, p.103) laments how reforms have not improved the performance of Philippine education, despite the fact that these are based on studies cumulative across a century (1900-2000), in fact even kicking off from the Monroe Survey of 1925. He also appears to be critical of the preparedness as well as adequacy of the number of the teachers who can challenge and nurture future knowledge workers, a collective body of intellectuals capable of lifting the economy to that level of highly progressive countries (Ibid. p.109).

Philippine Education for the 21st Century (1999, p.50) reveals that short-course training has to be provided, whether by employing companies or training institutions, in order to sufficiently equip graduates for the job they will later engage. This additional requirement entry to a job all adds up to the gloomy development in Philippine education. It means that the education fails to cultivate needed skills and competence among graduates. Not a few companies establish a more rigorous screening hiring process. They want to invest only in those applicants who can absorb within a limited period of time the necessary knowledge and skills for the job. This redounds to more graduates ending up underemployed, and much worst, unemployed. Parents and high school graduates may have at least two good alternatives: they enroll in a good university, and take the risk their money as a kind of investment; or enroll in a public university or mediocre private college, and are consoled by the fact that at least they will not be spending that much if in case the degree fails to earn the financial reward. Several higher education institutions, most of them having accreditation credential, have survived this period of pessimism in education by multiplying their programs to give parents and students choices (Bernardo, 2005, p.118).

Addressing the Problems and Needs of Philippine Education Scholars and educators have been seeking ways to solve the current problems of education. Thus, they propose programs that intend to revise the curriculum and instructional system as well as overhaul the infrastructure upon which the Philippine education system rises. Padolina (2005, p.41) recognizes the strength of higher education that displays these three elements: diverse, flexible, and accessible. Areas of studies and program types must be diverse, readily meeting students' interests and needs altogether with the demands of certain industries. These studies and programs should be ladderized and short-cycled. They must have revolving entry-exit doors.

Developing them by "addressing a narrow range of objectives, accountable to a well-defined set of standards, serving a specific clientele, satisfying a particular set of stakeholders, and requiring a more circumscribed set of resources," Bernardo (2005, p.106) has proposed types of higher education institutions that satisfy the demands of the future.

The evolution of these types of learning institution has been ushered by the rapid changes in science, technology, and communication. Padolina (2005, p.43, 47) points to the emergence of global universities which constitute a kind of global learning environment where students, learning activities, and research cohere as mega-morphing structure "via computer networks, satellite television and videoconferencing." International alliances and agreements are made such as Global Alliance for Transitional to ensure the viability of such global universities.

Beyond the idea of global university is something unthinkable. Perhaps the next stage could be the extinction universities as foretold by Peter Ducker - the classroom will be located in the networld of communication and information technologies (Ibid. p.46). Caragues (2005, p.168) may have thought of typical classroom-less learning providers.

Philippine Education for the 21st Century (1999, p.6) suggests that education must have the creative content and structure that can meet aptly the fluidity of labor market demands. Knowledge economy allows "workers to move efficiently across sectors as the economic changes are centrally important" (Ibid. p.2). Certain jobs that have significant economic impact are ephemeral and peripheral. They are needed in a relative period of time, and they proliferate in certain places. Suddenly they are gone, or are the jobs which look different. There are jobs that grow up from the existence and constant refinement of certain highly complex skills. Thus, the education infrastructure and programs must be prepared both to adequately equip the knowledge workers with the required minimum of skills, and to competently retool them with those new and advanced. Educators hold that "to achieve regional competitiveness, the Philippines requires a workforce that is literate and skilled in high-end, middle level-end and lower-end skills" (Ibid. p.53).

Progress and Knowledge

Globalization spurs the high volatility of jobs and their required skills. The volatility makes a set of higher skills suddenly a minimum requirement. This occurs by combining a number of jobs into "superordinate" jobs, thus eliminating jobs perceived to be unnecessary. Further more it also creates jobs with upscaled requirement as well as fuzzily labeling and defining certain jobs. Whatever the case, it shows how unpredictable the trend and effects of globalization. The definition of globalization indicates grandness in scope and depth. It refers to "the integration of markets into a common whole, the uniting of peoples of distant locations and varying cultures, the socioeconomic efforts of international organizations in bringing about improvements of well-being through peace and development" (Tan, 2000, p.230).

Globalization has given rise to a different type of business and industrial organizations, the cybercorps. Padolina (2005, p.40) describes a cybercorp (quoting from the book James Martin published in 1996) as "a corporation designed using the principles of cybernetics [. . . designed for fast change, which can learn, evolve, and transform itself rapidly]." This organization has cells, tissues, organs, and systems all constituted and pervaded by the use of knowledge. It exists through knowledge - creating, distilling, exploiting, and disseminating its various forms and uses. The workers have become knowledge resources, capable of endless cycle of learning and relearning.

Though the Philippines already has companies which could be considered cybercorporations, the U.S. and Western may have been several steps ahead of the curve with their global universities such as MIT, Cambridge, Harvard, Sorborne, etc., quarrying and salting away knowledge (Tan, 2000, p.231). Particular knowledge, though, can be made available to the public without posing harm or disadvantage to the institutions which produce it. This knowledge has become generic, presented as principles and theories. Since they can be available in commercial and disseminative form, they constitute an industry of their own when they are published in books, CDs, journals, and electronic products.

The equation of knowledge and money has become the e = mc2 of knowledge economy. Thus, it could be understood why new, highly advanced, and critically revolutionary intellectual products have to be protected. Enormous amount of money is invested into these products. Some huge amount of money can also be generated from selling them. Knowledge, anyway, especially the one which has many applications and can cut across many areas of economic activities, may be a extra valuable, if the idea of e = mc2 holds up as economic jargon. However, the parallel formula proposed here could be w = kt2, i.e., wealth is equal to knowledge as developed by time and more time.

This suggests that there is a direct relationship between the accumulation of knowledge and wealth as well as the passing of time. Science and technology today is a product of the growth of knowledge. Its impact on the material progress of the society propels its growth. The material prosperity that knowledge has created provides plenty of resources for the growth of knowledge. The passing of time, though, lays the ground for the growth of knowledge to benefit on innovation, creativity, serendipity, and exploration. To illustrate this simply, the space exploration today may have its beginning in the discovery of the use of iron of a thousand of years ago.

Peter Drucker may just be half right when he prognosticated "that one of the critical forces that will move and shape our future is knowledge" (Padolina, 2005, p.39). It has not been one of the forces, if we follow the argument shaping up to this part of the discussion. In fact it has been the only force that is kneading the future. In fact, it is the force that crafted the past, and it is the force that is creating the present. Knowledge is always constant, while money may be the variable that changes through time because it always realizes itself in material nature. Drucker is quoted to say, "The world is becoming not labor intensive, but knowledge intensive" (Ibid. p.39). This is disputable also. The world has always been knowledge intensive. The first appearance of the earliest form of technology, such as old stone ax and knife, was produced by knowledge.

Drucker conceives knowledge only within the paradigm of high technology and advanced science. Knowledge is a process, and it is people who think and appreciate it as something material. In this sense the space rocket is a product of the development of knowledge since hundreds of years ago. Its materialization to what is now in the present proves evidence that knowledge is indeed a process.

There are various attempts to define what constitutes knowledge, in the process leading to the classification of knowledge, especially within the framework of knowledge economy, and these types are know-what, know-why, know-how, and know-who (Padolina, 2005, p.40). Science is also an all-encompassing type of knowledge that is both immensely credited for the bustling progress in economy and is feverishly blamed for its worsening slump (Tan, 2000, 232).

Reframing the Concept of Quality Education

Advancement in science depends on education. However, some measures of development in education do not simply add up to how science is making headway. This could be observed in the relation between the higher education performance and the job market capability to absorb college graduates. The assumption that the pace of economic development can be indexed on the result of the cultivation of human resource needs to be clarified. Education, which largely has something to do with the cultivation of the minds and hands, has to be gauged not only in terms of quantity, which is the measure essentially captures by the idea of literacy rate, but also quality, which is the measure that involves scrutiny of the contents of areas of knowledge such as science. To demonstrate this, Philippine once had the highest literacy rate, about 85%, "second to the United States in the production of college graduates, higher than Russia, and the highest in Asia, but its level of economic development was lower than countries with smaller numbers of college graduates" (Navarro, 2005, p.320). Somehow this indicates that Philippine education should be examined in terms of quality. Questions on what is taught and how useful the knowledge taught in improving the economy have to be addressed.

Philippine Education for the 21st Century (1999, p.6) has been echoing problems that have to be settled in order to tackle the questions on quality. It reported:

. . . quality of teaching and learning will require that a number of curriculum and assessment issues be addressed, such as streamlining the curriculum in primary education, revising the programs for mathematics and science at the secondary level, extending the length of basic education (by expanding the coverage of preschool services and introducing, where warranted, a bridging year between secondary and tertiary education), using vernacular languages in the first years of elementary education, and overhauling the national assessment system. . .

It also bewails the shortage of qualified teachers on science and technological education. The report recommends "improving and expanding the output of science and technology programs" (Philippine Education for the 21st Century, 1999, p.6). There must be a rigid and focused approach "to build the S & T faculties of teachers' colleges and universities, where faculty qualifications are now low" (Ibid. p.49). The long-term goal of the rebuilt and reinvigorated education, particularly in the areas of science and technology, is to produce "people who can ask questions rather than people who have only answers" (Ibid. p.41).

To put everything so far in a nutshell, the knowledge economy has to be conceived in the framework of what Filipinos do to improve the quality of life. Who they are now has to play a role in the development of their own brand of knowledge economy. Thus, in some way, the relation between education and knowledge economy redounds to a kind of philosophy of education (Quito, 2005, p.67). This philosophy sees knowledge, which is gained from source outside the country, being applied to Filipino realities that are to be shaped by them; on the other hand, it consequently changes the latter for the better (Ibid. p.70). Certain proposals to improve Philippine education, an education that has the quality to improve Philippine knowledge economy, are discussed further here.

Method

This study employed the narrative aspect of meta-analysis. It aimed to examine the data presented in several studies to find out how they inform the assumptions that are proposed here. These assumptions explain knowledge, economy, and education as theoretical and philosophical concepts. They also establish the relationship among them.

Presentation and Discussion

It is quite clear from the discussion that the framing of economy in terms of the creation and exploitation of knowledge warrants the examination of the state of education. This however goes beyond the evaluation of education in terms of the literacy rate. It is not enough that people can read and write. It is more important how far they have learned in reading and writing. In literacy, they must generate knowledge. Likewise, educators must be concerned of what kind of knowledge a school, teachers, and students have to preoccupy themselves, and this means two things: producing it when it is not yet in existence, and transforming it when its form is not yet ready-for-use to the present realities. Engineers and planners of education have to be realistic on what to achieve in the quest for knowledge and its use, and if progress is achieved, how far the quest can go. Resources have to be identified and tapped. Their exploration and utilization has to be rationalized. Various findings and data related to the state and progress of Philippine education have to be studied to understand the present crisis of education. They provide some piecemeal history of what has happened and is happening in the present education.

Learning from the Past

Navarro (2005, p.320) studied how the various levels of education responded to the Presidential Commission to Survey Philippine Education (PCSPE) recommendations, which were crafted into Philippine Educational Development Act of 1973. She believed that though "the post-secondary technical-vocational education sector responded positively to the decree's prescription for closer industry-education linkage," the tertiary education did not. Though some (JRU, UP Diliman, Lasalle and Ateneo as the best examples) have been reinforcing their effort on industry cooperation and linkage, most universities are absorbed in how their education programs worked, not exerting some concerted and well-thought actions to meet the needs of the industry, of which majority of their student-clientele will seek employment into later. This has resulted in "the phenomenon of the educated unemployed and under-employed in the Philippines," which has been multiplying of alarming magnitude every year (Ibid. p.321).

Navarro (2005, p.323) revealed this yawning mismatch on Table 1 below. But the table also shows certain facts. Within 20 years, from 1982 to 2003, though enrollment had increased from 1.3 million to 2.6 million, for 2003 only 370,000 of the students would eventually graduate and seek work. In this year alone, a total of 50,000 of higher education graduates would be joining the ballooning number of surplus educated graduates being churned out annually. The statistics do not reveal how many of the graduates were still unemployed by 2002. Certain statistics suggest that currently there are about 10 millions of the Filipinos who are unemployed. A large percentage of this number may be college graduates. With four million of the country's human resources employed abroad by 2003, and more so today, the jury is out there passing a clear verdict that the country needs a different type of knowledge economy.

Table 1.Higher Education Performance 1982-2003.

HIE Statistics	1982	2003	Growth Rate
Enrolment	1.3M	2.6 M	100%
Graduate	140,000	370,000	164%
Surplus educated graduates	84,000	50,000	495%
Overseas Filipino workers	800,000	4M	400%

This knowledge economy thrives on low-key knowledge, a kind of knowledge that has potential for growth and can beneficially radiate immediately in the economic progress of a country. Perhaps recognizing such kind of knowledge, Tan (2000, p.233) advocates concentrating on "the low and medium technology industries (in contrast to advanced knowledge-based industries)." She adds that "these industries include food production and processing, services in entertainment, health, finance, the professions and government, construction, transport, utilities transport." For her as she shares the belief in the role of education and school science to technology, she reflects on what Physics Nobel lareate Absul Salam and Azim Kidwai have said on prioritizing science education. Agreeing with them, she is for teaching education at all levels and for "minimum science content of curriculum and a 50 percent share of S & T majors in universities"(Ibid. p.233).

An examination of the higher science and technology education of the country can be informed by assessing how lower education has been performing. It is worthy of note, however, that the Filipinos really recognize the importance of education. *Philippine Education for the 21st Century* (1999, p.153) reports the constant growth of enrollment in public and private elementary and secondary schools from 1939 to 2011, the data of which are found in Table 2 below. This table shows data that, which is aside from hinting some answers, could draw enlightening questions. After the years of 1939-1940, and at least for five decades later, the numbers of enrollees entering high school were bigger than those entering elementary. On growth percentage, of 10.3% who enrolled in 1960-1961 in elementary, there were 47.7% who entered high school. The trend afterwards was 65.9% who entered elementary to 181.8% who enrolled in high school in 1970-1971; 19.0% in elementary to 75.6% in high school in 1980-1981; 25.8% in elementary to 44.3% in high school in 1990-1991; and 10.3% in elementary to 12.2% in high school.

The data on the last decades of this enrollment in elementary-high school ratio suggest the reverse of this trend: 11.6% in elementary to 6.4% in high school in 1998-1999, 5.4% in elementary to 4.5% in high school in 2000-2001, and 29.8% elementary to 25.0% in high school in 2010-2011.

The questions that arise with this irregular trend are as follows:

1. What prompted such abrupt reversal of increases and decreases?
2. Why for more than three decades the trend seems to show the unnatural pattern, meaning rather than the percentage of the enrollees bigger in elementary than that of secondary it was the other way around?

One common explanation on why there had been a petering out of enrollees from elementary to high school is the drop out rate gets higher as the requirement of schooling gets more stringent. However, more reasons can be offered.

In 1948-1949, the trend was just natural – there was the downturn in enrollment from elementary to high school (from 315.6% to 166.5%). The huge decrease in the number of children not completing high school owes some explanation. This enrollment downturn could be due to the mentality and practice influenced by the harsh life after WW II.

Filipino children wanted to work, and their parents reluctantly agreed because the family could barely meet their needs. Though it was indeed a difficult time, it could also be an opportunity to get ahead in life with prosperity may be just around the corner for some. Some parents and children thought of this. Filipinos, during some years after the war, also assumed they had already received adequate education by just completing elementary.

The next years from 1960-1961 to 1995-1996 had the odd upturn trend, meaning the percentage of enrollment increased from elementary to secondary. Though there are no data supporting such assumption, it was possible that a multitude of older Filipinos had gone back to school to finish high school education. Life could have been better, and more schools could have been built during these decades. The years 1970-1971 saw the highest increase in growth percentage in the number of enrollees entering high school, which was 181.8% compared to 65.9% in the elementary.

Table 2. Enrollment Trends and Projections in Public and Private Elementary and Secondary Schools, 1939-2011(thousands).

School Year	Public	Private	Total	% Growth Total
Elementary				
1939/40	850	63	916	-
1948/49	3,693	114	3,807	315.6
1960/61	4,003	196	4,200	10.3
1970/71	6,628	341	6,969	65.9
1980/81	7,931	359	8,290	19.0
1990/91	9,728	699	10,427	25.8
1995/96	10,646	859	11,505	10.3
1998/99	11,876	968	12,844	11.6
2000/01	12,483	1,050	13,531	5.4
2010/11	16,029	1,578	17,559	29.8
Secondary				
1939/40	91	64	155	-
1948/49	193	220	413	166.5
1960/61	192	418	610	47.7
1970/71	763	956	1,719	181.8
1980/81	1,615	1,404	3,019	75.6
1990/91	2,960	1,395	4,355	44.3
1995/96	3,376	1,507	4,883	12.2
1998/99	3,793	1,403	5,196	6.4
2000/01	4,036	1,405	5,431	4.5
2010/11	5,502	1,415	6,772	25.0

Original sources: World Bank (1988) for 1939/40 to 1980/81; DECS Statistical Bulletins 1991-1996 for 1`990/91 to 1995/96 data; and DECS Statistical and Research Unit for 1998/99 data. Paper source: Philippine Education for the 21st Century p.153.

Ferdinand Marcos might have instituted reform in education, and might have aggressively enticed Filipinos to continue their secondary education. This perhaps contributed to the claim that the country once had the highest literacy rate.

The next three pairs of years show the normal trend in growth percentage: 11.6% in elementary and 6.4% in high school in 1998-1999; 5.4 in elementary and 4.5 in high school in 2000-2001; and 29.8 in elementary and 25.0 in high school in 2010-2011. Though erratic, the trend suggests that there has been a decrease in the number of enrollees from elementary to high school. Among the 25.0% who entered high school, one-third of them most likely would enroll in college, and probably the same shrinking percentage would get their degrees. A very small number would pursue graduate education. The trend does not augur well in preparing a sufficient number of intellectual workers whose impact economic duplicates those of highly advanced knowledge economies.

Table 3 reveals how Filipino elementary and high school students dismally performed. They again scored the lowest in the content areas of Earth Science, Life Science, Physics, Chemistry, and Environmental Issues and Nature of Science. Their scores on Physics and Chemistry convey the huge need for improvement in the Philippine Science curriculum as well that in the training and preparation of Science teachers. The lower grade scored in average 36 on Physics and 27 on Chemistry. The average scores of lower grade of other countries were 50 on Physics and 43 on Chemistry. The scores of Singapore were much better with 62 on Physics and 57 on Chemistry. The upper grade did not improve much with 39 on Physics and 31 on Chemistry. The average scores of upper grade also increased, with 55 on Physics and 51 on Chemistry. The scores of Singapore were impressive at 69 both on Physics and Chemistry.

Tan (2000) studied science and technology capabilities of the country by examining crucial areas and variables of education. These factors are college enrollment by field of specialization, budget allotted, and research paper published in recognized professional and scientific journal. On Table 4, in the school year of 1996-1997, out of 1,316 number of higher education institutions surveyed, the course of Business had the highest number of enrollees at 775,335, getting 34.9 percentage. Far second was Engineering with 305,843, and tailing close third was Teaching and Training with 301, 148 enrollees. Coming fourth was Mathematical and Computer Science with 153,505, and distant sixth after General courses was Agriculture with 71,228. The rest of the courses included in the study were Fine Arts, Humanities, and Natural Sciences.

Table 5 below shows that in 1998 DECS education and research had the largest budget; it was 78,520 (in millions), equivalent to 76.9% of the allotted budget for education. Among the three institutions related to learning, DOST receive 3,262, TESDA 3,005, and CHED 2,669. This size of budget could be related to the percent increase in the number science and technology research papers and articles accepted to ISI Journal. The percent increase attests to the insufficiency of the budget

Table 4. Distribution of College Enrollment by Field of Specialization, 1996-1997.

	Number	Percentage %)
Teaching training	301,148	13.6
Fine Arts	10, 922	0.5
Humanities	14, 014	0.6
Business	775, 335	34.9
Natural Sciences	20, 031	0.9
Mathematical and Computer	153,505	6.9
Science	305, 843	13.8
Engineering	71, 228	3.2
Agriculture	107, 351	4.8_
General		
Total	2, 220. 838	100.00
Number of Tertiary Institutions	1,316	100.00
Government	271	20.6
Private	1,045	79.4

Original source: National Economic Development Authority, Philippine Statistical Yearbook, 1999. Paper source: Tan, 2000, p.234.

Table 5.Budget for Education and Research, 1998 (P Million).

	Number	Percentage (%)
DECS	78,520	76.9
TESDA	3,005	2.9
CHED	2,669	2.6
DOST	3,262	3.2
PCASTRD (R & D)	57	-
ASTI	36	-
SUC	14,632	14.3
UP	4,201	(4.1)
UP Research	395	(0.4)
Total as % GNP	102,088	100.00
DOST & Research in UP	2,794,368	3.7
		0.12

Original source: General Appropriations Act 1998, NEDA Statistical Yearbook, 1999. Paper source: Tan, 2000, p. 235.

Table 6 reveals that in a ratio of one scientist/engineer to a million of Filipinos in 1990, the Philippines had 60; in 1994 Singapore had 2,512; in 1994 Korea 2,636; in 1993 China 1,993; and in 1993 Taiwan 1,669. The Philippines was the lowest in scientist/engineer-million population ratio. It also had the lowest research and development expenditure per GNP in 1996, which was 0.1.

It is interesting to know how these factors of enrollment-graduate ratio by field of specialization (particularly science and engineering), budget allotted, and research published in recognized professional and scientific journal publication impacted on certain industries in the economy. As revealed in Table 7, advanced technologies in Microbiology and Biotechnology, Photonics, Microelectric, and Genetics scored very low. Robotics, Material and Artificial were way below 3.

Table 3. Science Achievement in the Philippines and Other Countries

Content Area	International		Singapore		Philippines	
	Lower Grade	Upper Grade	Lower Grade	Upper Grade	Lower Grade	Upper Grade
Earth Science	50	55	60	65	37	40
Life Science	53	59	62	72	38	38
Physics	50	55	62	69	36	39
Chemistry	43	51	57	69	27	31
Environmental Issues and Nature of Science	47	53	62	74	37	38

a unweighted scores.

Original source: DECS, Bureau of Secondary Education using data from International Association for the Evaluation of Educational Achievement 1997. Paper source: *Philippine Education for the 21st Century* p.178

If the highest score was 10, this suggests disastrous the performance of these technologies in the industries of Energy, Steel, Chemicals, and Machinery. Nonetheless, in the industries of Food, Heal Care Pharmaceutical, and Environment those advanced technologies had performed better with 6 above average.

Table 6.R&D Employment and R&D Expenditure per GDP ca 1990.

	Scientists Engineers per Million population	R&D Expenditure Per GDP 1996
Philippines	60	0.1
(1990)	2,512	1.1
Singapore	2,636	2.8
(1994)	1,669	1.7
Korea (1994)	87	0.4
Taiwan	173	0.2
(1993)	1,993	0.6
Malaysia	181	0.2
(1992)		
Thailand		
(1991)		
China (1993)		
Indonesia		
(1988)		

Original source: UNESCO Statistical Yearbook 1996: for Taiwan, Taiwan Statistical Data Bank, 1994, Council for Economic Planning and Development; per capita R&D expenditures from World Competitiveness Online, IMD. Paper source: Tan, 2000, p.247.

It is interesting to know how these factors of enrollment-graduate ratio by field of specialization (particularly science and engineering), budget allotted, and research published in recognized professional and scientific journal publication impacted on certain industries in the economy. As revealed in Table 7, advanced technologies in Microbiology and Biotechnology, Photonics, Microelectric, and Genetics scored very low. Robotics, Material and Artificial were way below 3. If the highest score was 10, this suggests disastrous the performance of these technologies in the industries of Energy, Steel, Chemicals, and Machinery. Nonetheless, in the industries of Food, Heal Care Pharmaceutical, and Environment those advanced technologies had performed better with 6 above average.

As pointed out, the Philippines has been keeping afloat in these many years of economic turbulence because it has evolved a different type of knowledge economy. It has an army of workers whose skills are needed in other countries.

In 2005-2006, it had deployed 8 million workers who sent home 12 to 14 billion dollars (*Next 500 Corporations: Business Profiles 2005-2006*, p.2). The Information and Communication outsourcing, which consists of Information Technology Outsourcing (ITO) and Business Process Outsourcing (BPO), has tremendously contributed to buoying Philippine economy. In 2005-2006, the country was ranked next to India in Asia, which had "attained a 100% growth in 2005, from 40,000 seats in 2004 to 80,000 seats in 2005, the fastest in the whole of Asia" (Ibid. p.5). Bernardo M. Villegas, one of the most outstanding economists in the Philippines, gushed on the huge economic splash created by BPO industry.

Villegas refutes the common notion that BPO is all about college graduates and undergraduates, who have been seriously trained to communicate in certain prestigious dialects of English, Korean, Chinese, and other languages. He pointed out "the larger share of the global BPO industry involves non-voice processes such as animation, accounting and finance, and medical transcription" (*Next 500 Corporations: Business Profiles 2005-2006*, p.5). Degree holders in accounting and related areas of study, which for the last 10 years may have reached to a billion, enjoy the greener pastures created by "knowledge process outsourcing, such as data search, integration and management services, financial services, research and analysis technology research, computer-aided simulation and engineering design and professional services such as business research and legal service" (Ibid. p.5). More opportunity beckons as McKinsey Global Institute observes the scantiness of the human resources of China that can meet expansionist ambitions of its multinational companies (Ibid. p.6).

Tourism is another industry that propels the indigenous type of knowledge economy of the Philippines. It is one of the motors of the economy identified, aside BPO and overseas employment (*Next 500 Corporations: Business Profiles 2005-2006*, p.6). Other industries displaying potential are "logistics, garments, agribusiness, and furniture exports." Nevertheless, tourism portends the most promising. According to MasterCard International, by 2015, personal travel spending around the globe "would reach US $4.6 trillion, or 11% of the world's personal consumption," "an annual growth rate of 5.1%" (Ibid. p.3). On the other hand, non-travel spending would rise only to US$963 billion in 2015, with an average annual rate growth of 4%. The tourism industry pulsates its prosperity in other industries such as in construction, communication, transportation, entertainment, food, marketing, retailing, and advertising (Ibid. p.4).

Table 7. Advanced Technologies and Impact Scores on Selected Industries.

Industry	MBB	Photonics	Materials	Robotics	Microelect.	Genetic	Artificial
Energy	2	1	3	2	1	1	2
Steel	1	1	3	2	1	1	2
Cement	1	1	1	2	1	1	2
Chemicals	1	1	3	3	1	3	2
Construction	1	1	3	3	1	1	3
Machinery	2	2	3	3	1	1	3
Textile	1	1	3	3	1	3	2
Subtotal	9	8	19	18	7	11	15
Food	6	4	5	4	4	12	4
Health Care Pharmaceutical	6	7	6	5	6	7	4
Environment	9	6	9	7	6	9	3
Total	51	42	49	40	30	46	47

Original source: Jose Magpantay, Science and Technology in the Philippines: An Assessment, Forecast and Evaluation of Options, Technology Foundations, University of the Philippines, Diliman, Quezon City, 1998. Paper source: Tan, 2000, p.244.

The industry can even significantly serve certain programs and activities, which promote history and culture. Each dollar and peso spent has income multiplier effect, "the total economic activity generated in a local economy for each dollar spent" (Ibid. p.4).

The Department of Trade and Industry has identified the sectors of mining technology, electronics, motor vehicle products, energy, infrastructure, tourism, shipbuilding/shipping, jewelry, fashion garments, industrial tree plantation, iron and steel, exploration, mining, quarrying and processing minerals, industrial tree plantation, development and self-reliance of disabled persons as opulent enough to attract investors (*Next 500 Corporations: Business Profiles 2005-2006*, p1). The industry of mining has been enticing to prospectors and venture-makers (*Top 700 Corporations: Business Profiles 2005-2006*, p.2). Villegas has lauded the rich source of skill workers in the Philippines because they are highly sought abroad, particularly in "the area of technological infrastructure (especially telecom) in which it was ranked higher than China and Indonesia" (Ibid. p.3).

This information examined so far suggests the current state of the knowledge economy of the Philippines. The high literacy rate of the country has been brought about by some historical event expediency – austere life after World War II, in which more aged people going to finish school, and the Marcos dictatorship. The decades of the 1990s and 2000s somehow display the hollowness of this high literacy. The results of international achievement tests on Science and Mathematics expose how the Philippine education has been lagging behind that of its Asian neighbors. More telling evidence are disclosed in the examination of college enrollment by field of specialization, budget allotted, and research paper published in recognized professional and scientific journal.

There were few enrollees in areas essential for the advancement of science and technology. The Philippine higher educational institutions such as UP System could only produce a limited number of holders of Ph.D. in priority areas including the science of environmental protection. The budget for research and development was meager. The country was being left too far behind in the number of research papers accepted in acknowledged international educational and scientific journals. The ratio of scientist per person in the country was one per million. The impact of technology certain low-key technological industries such Microbiology and Biotechnology, Photonics, Microelectric, and Genetics is likely to be described insignificant. However, tourism, information and communication outsourcing, and manpower export are credited to be the three drivers of the economy.

Looking Ahead With Reforms

This research argues for the revision of curriculum for all levels. Most parents and certain sectors of the society voice their dissension against adding more years in elementary education. The evidence presented so far suggests that at least two more years of education are not an option anymore but a reality. The countries with highly advanced knowledge economy have more number of years in elementary and high school. There are options to deal with this impasse. Below are some of the suggestions:

1. Adjust the age of the start of schooling to 5.

a. Preparatory or kindergarten can absorb some of the curriculum of Grade 1. Reading, writing, listening, and speaking have to begin here. Elementary schools must be required to have preparatory or kindergarten.

b. Entry to Grade 1 requires a specific level of skills, which are in turn supplied by kindergarten. There should be entry-level test. Entry should be strict.

c. There must be alternative type of schooling where those skills required can be obtained. Parents and family belong to this type of education, aside from media or electronic mediated form.

1. Elementary schools can be the sources of learning materials. Auxiliary teachers can provide assistance to parents. The schools can serve as consultants.
2. Technology should be used to open the schools as sources of consultants. Video conferencing and Internet various forms of correspondence can be used.
3. The government, local and national, should fund this type of education. There may be other sources of fund. Parents, teachers, and specialists should be encouraged to form organizations and networks for the promotion of this early childhood organization. Parents and family should burden the responsibility of early childhood education.
4. The entry-level skill test must have a different set for children who retake it. Those who still score below average can be placed in classes where instruction is calibrated to meet their demands.

2. Strengthen the requirements of entry of Grade 6 and that of 1st Year High School.

a. There must be entry level of skill tests from Grade 5 to Grade 6 and from Grade 6 to 1st High School.

b. The students who failed to pass must be encouraged (not required) to attend summer classes. Alternative schooling just like of early childhood education is allowed. The schools, other learning institutions, and organizations can be enlisted for assistance and consultancy. Parents and family should burden the responsibility of late childhood education.

c. The entry-level skill test must have a different set for children who retake it. Those who still score below average can be placed in classes where instruction is calibrated to meet their demands.

3. There should be optional 5th Year in High School. This provides occupational education which meets the demand of the geographical place and industry.

a. Students who passed the entry-level skill test can finish Associate college courses aligned with the education that they have taken in high school for 1- and ½-years of units requirement. The scores on the skill test may also be used to determine the units to be completed for Associate college courses.

b. The industry and university may accommodate the granting of non-diploma Associate degrees on the merits of years of experience, training, and work competence.

4. Reforms should be made in education related to those who work in school setting (teaching personnel).

a. Test construction should be one area in normal education that should be professionalized. Those who want to engage in test construction should be encouraged to specialize at it.

b. Teaching consultancy can also be created as a school-related profession. Aside from knowledge in teaching and learning those who engage in this profession should be trained to organize and counsel teachers, parents, and other stakeholders of education. They must also have skills in marketing as well as technological savvy.

c. Certain training, experience, and competence may be allowed as equivalency for the qualification of parateaching and auxiliary teaching staff.

d. Specialization in teacher education both for overachieving and underachieving children should be opened. The entry tests would identify children who need a different kind of teaching approach. A school may really have to create a different learning niche for children who have needs which vary gravely from that of most of the learners.

Bibliography

Asian Development Bank. (1999). Philippine Education for the 21st Century: The 1998 Philippine Education Sector Study. Philippines: Asian Development Bank.

Asilo, Francis Alvin and Saudi, Nino Emmanuel. (October, 2005). The Contributions of Overseas Filipino Workers to the Philippine Economy. UP Diliman: Undergraduate paper.

Bailey, Thomas R. (1998). *The Integration of Work and School – Education and the Changing Workplace* in Education Through Occupation in American High Schools – Approaches to Integrating Academic and Vocational Education. Volume 1. New York: Teachers College Press.

Bernardo, Allan B. I. (2005). A 100-Year Proposition for the Evolution of Philippine Colleges and Universities in *Philippine Education in the Third Millennium: Trends, Issues, Challenges, and Concerns*. Philippines: GNS Enterpriser.

Carague, Ofelia M. (2005). Challenges of Technology in Education in *Philippine Education in the Third Millennium: Trends, Issues, Challenges, and Concerns*. Philippines: GNS Enterpriser.

Education Through Occupation in American High Schools – Approaches to Integrating Academic and Vocational Education. (1998). Volume 1. New York: Teachers College Press.

Grubb, Norton W. (1998). *The Cunning Hand, the Cultured Mind – Sources of Support for Curriculum Integration* in Education Through Occupation in American High Schools – Approaches to Integrating Academic and Vocational Education. Volume 1. New York: Teachers College Press.

Houghton, John and Sheehan, Peter. (February, 2000). A Primer on the Knowledge Economy. Victoria University: Center for Strategic Economic Studies.

Navarro, Rosita L. (2005). University-Industry Collaboration Education in *Philippine Education in the Third Millennium: Trends, Issues, Challenges, and Concerns*. Philippines: GNS Enterpriser.

Next 500 Corporations: Business Profiles 2005-2006, A Very Resilient Philippine Economy. (2005). Philippines: Philippine Business Profile and Perspectives, Inc.

Padolina, Cristina Damasco. (2005). Making Pathways for and Creating the Future of Education in *Philippine Education in the Third Millennium: Trends, Issues, Challenges, and Concerns*. Philippines: GNS Enterpriser.

Quito, Emerita. (2005). Philosophy of Education for Filipinos in Bernardo, Allan and Borromeo (eds.), *Visions for Education: Essays in Philippine Education in Honor of Bro. Andrew Gonzales, FSC*. Philippine: De La Salle University Press, Inc.

Tan, Edita. (2000). Is the Philippines prepared for globalization an assessment of its science and technology capabilities? in Canlas, Dante and Fujisaki, Shigecki (eds.*) The Philippine Economics: Alternatives for the 21st Century*. Philippines: Institute of Development Coping Economies, Japan External Trade Organization.

Termulo, Mary Grace S. (May, 2005). High Performing, High Priority Public Secondary Schools, A Model for Educational Management. UP Diliman: College of Education.

Top 700 Corporations: Business Profiles 2005-2006, A Very Resilient Philippine Economy. (2005). Philippines: Business Profile and Perspectives, Inc.