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Recent TFP Policy Agenda for the Philippines

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Philippine Institute for Development Studies

Recent TFP Policy Agenda for the Philippines

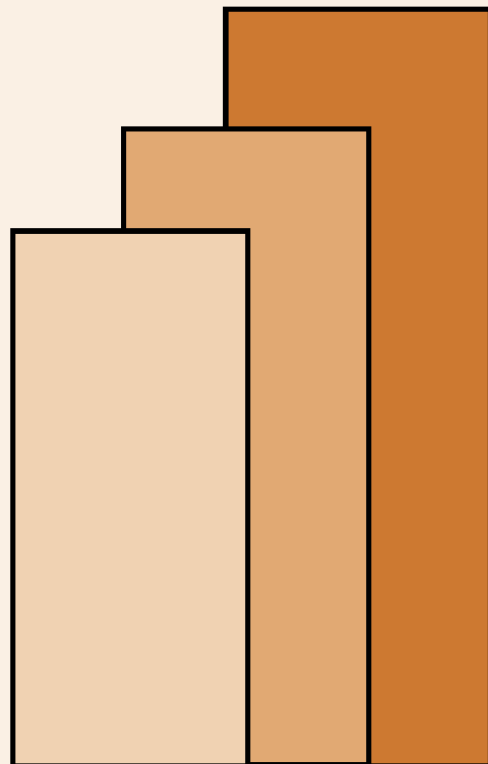
Caesar B. Cororaton and Socorro Zingapan

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Recent TFP Policy Agenda for the Philippines

Abstract

The paper argues that one of the major factors that led to the unsustainable economic growth in the Philippines in the last three to four decades is low productivity. The paper surveyed empirical results on Philippine total factor productivity (TFP) and found that, indeed, TFP has been declining. The paper also looked into some general factors that may have affected TFP and observed that trade liberalization, export expansion, stable economy, research and development, foreign direct investment are factors that tend to have positive effect on TFP, while the increase in real minimum wage tends to have the opposite effect.

Policy reforms are being implemented in the Philippines especially in the areas of foreign trade, foreign investment and macroeconomy. These reforms are generally consistent with the effort to improve TFP. Furthermore, the Philippines launched a productivity program called the National Action Agenda for Productivity that addresses specific issues and problems in productivity. However, there are still major institutional gaps in research and development, in particular, and in science and technology, in general, that remain to be addressed.

Recent TFP Policy Agenda for the Philippines

By

Caesar Cororaton and Socorro Zingapan¹

This paper gives an overview of current efforts in the Philippines towards defining policies on total factor productivity (TFP). The first section presents the development backdrop of TFP policies as well as various estimates of TFP for the Philippines and their policy implications. Section II discusses the overview of the framework of policy intervention. The last section focuses on relevant issues pertaining to research and development (R&D).

I. Background

A. Historical Growth Path

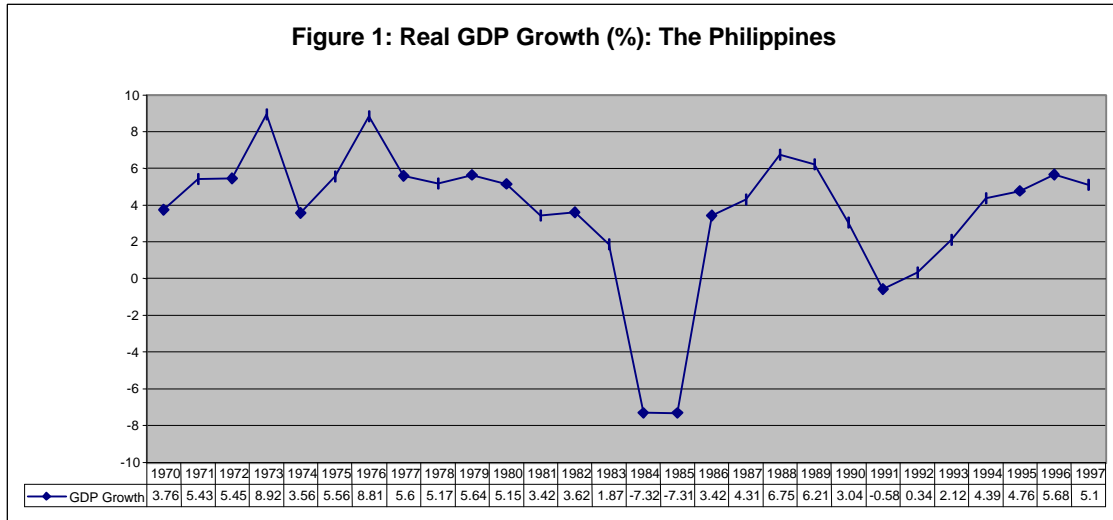
The Philippines has gone through decades of development predominantly characterized by “boom and bust” cycles of growth (see Figure 1). While in recent years (1993-1997), GDP growth averaged at 4.4 percent and peaked at 5.7 percent in 1996, this was preceded by three years of recession (1989-1991). This growth path also describes those of previous periods.

Associated with this unstable path is the low income of the country's population. As of 1997, the average income of Filipinos amounts to US\$1,184 in nominal terms. Ranked against the Newly Industrialized Economies (NIEs) and the four countries in the Association of Southeast Asian Nations² (ASEAN-4), this income is considerably low. Notwithstanding some gains in recent years, indicators of poverty incidence also support this inferior ranking.³

¹ Fellow of the Philippine Institute for Development Studies (PIDS) and Director of the National Planning Staff-National Economic and Development Authority, respectively.

² Singapore, Malaysia, Thailand, and Indonesia.

³ Poverty incidence of families improved to 32 percent in 1997 from 35 percent in 1994, and 41 percent in 1991.



Source: National Statistical Coordination Board, various issues

Qualitative assessments of this growth path have already been made (e.g., National Economic and Development Authority, NEDA, 1998). In essence, episodes of growth of the Philippine economy have been made largely through expansions in employment and other production inputs rather than productivity improvement. For instance, the average growth of employment in 1996 exceeded actual GDP growth although there were some years when the reverse was evident (see Table 1). Further quantitative evidences of recent trends may be found in Lim (1998) and the work of Cororaton (1998) discussed below. A more extensive discussion of TFP estimates on past periods are surveyed below.

B. Survey of Productivity Indicators

There are a number of TFP results available in the literature on the Philippines. TFP estimates are for the entire Philippine economy, for some major sectors, and for some specific manufacturing sub-sectors (both at the level of 3-digit and 5-digit in the Philippine Standard Industrial Classification, PSIC). These TFP studies utilized various methodologies including the traditional growth accounting approach (using the simple growth and the Divisia-translog methods), econometric time-series analysis and macro-econometric modeling approach, the stochastic frontier approach, and linear programming method. Aside from

TFP, there are also results indicating the performance of both technical progress and technical efficiency of specific manufacturing industries.

Generally, the results indicate a not very encouraging performance of TFP. Declining TFP is borne out in the results of a number of productivity studies summarized in Table 2. For example, Williamson (1969) estimated a declining TFP from 55 percent in the period 1947-1955 to 15 percent in 1955-1965. The results of Sanchez (1983) and Patalinghug (1984) showed relatively constant TFP growth in the 1960s up to the early 1980s. However, the results of Austria and Martin (1992) showed a big drop in TFP growth in the period 1950-87 of 11 percent. The drop in productivity growth can be explained by the inability of the country to allocate its resources efficiently because of policies which intervened in the process of resource allocation.

Table 1: Real GDP and Employment, 1970-1997 (growth rates, in percent)

Year	GDP	Employment	Residual
1970	3.76	1.10	2.66
1971	5.43	7.80	-2.37
1972	5.45	4.80	0.65
1973	8.92	4.80	4.12
1974	3.56	3.20	0.36
1975	5.56	1.90	3.66
1976	8.81	5.20	3.61
1977	5.60	-2.30	7.90
1978	5.17	8.40	-3.23
1979	5.64	7.90	-2.26
1980	5.15	-6.60	11.75
1981	3.42	4.37	-0.95
1982	3.62	1.28	2.34
1983	1.87	5.85	-3.98
1984	-7.32	2.82	-10.14
1985	-7.31	0.85	-8.16
1986	3.42	3.86	-0.44
1987	4.31	6.39	-2.08
1988	6.75	5.81	0.94
1989	6.21	3.32	2.89
1990	3.04	1.39	1.65
1991	-0.58	3.16	-3.74
1992	0.34	3.41	-3.07
1993	2.12	2.90	-0.78
1994	4.39	2.67	1.72
1995	4.76	2.57	2.19
1996	5.68	5.88	-0.20
1997	5.10	1.95	3.15

Source: National Statistical Coordination Board, various issues

Table 2: Sources of Growth for the Philippine Economy

Author	Sector Coverage	Time Period	Capital	Labor	Land	Education	Technical Progress	GDP Growth
Williamson (1969)	Economy	1947-55	9	33	3	N.A.	55	7.3
Williamson (1969)	Economy	1955-65	25	54	5	N.A.	15	4.5
Sanchez (1983)	Economy	1960-73	24	52	N.A.	N.A.	24	4.6
Patalinghug (1984)	Economy	1960-82	48	23	N.A.	6	23	5.5
Austria & Martin (1992)	Economy	1950-87	87	24	N.A.	N.A.	-11	4.6
Hooley (1985)	Manufacturing	1957-80					Average TFP: 1957-70: 0.51 1971-80: -1.34 1957-80: -0.26	

Source: Austria & Martin (1992) and Hooley (1985)

The TFP results of Hooley (1985) on the manufacturing sector also show the same declining TFP trend. On the whole, the results indicate that over the period 1956-1980, manufacturing TFP decreased by 0.15 percent annually. Since 1975, TFP has been declining at an alarming rate of 2 percent or more per year.

Table 3: Recent TFP Estimates in the Philippines

Author	Year	Sector Coverage	Period Coverage	Method	TFP Estimates	Remarks
Austria	1998	Economy	1960-1997	Macro-econometric	-0.4%	Statistically Significant
Lim	1997	Industry & Services lumped	1975-1997	Econometric *	-0.9%	Statistically Significant
Cororaton et al	1996	Manufacturing	1956-1992	Stochastic Frontier	<i>Number of Industries with negative TFP:</i> 1956-70 : 3 1971-80 : 9 1981-92 : 10	
Cororaton & Abdula	1998	Manufacturing	1958-1992	Growth Accounting	0.029%	
Cororaton & Caparas	1998	Economy & Major Sectors	1980-1996	Growth Accounting	Economy: -0.096% Agri**: -1.305 Mining: 1.562 Mfg.: 1.007 Const.: -5.876 Util.: 4.383 Trans.: -0.683 Trade: -5.532 Finance: -6.836 Serv.: -1.809	

* coefficient of time trend

** where **Agri.** is agriculture; **Mfg.** manufacturing; **Const.** construction; **Util.** utilities; **Trans.** transportation; and **Serv.** other services.

Source: Austria (1998), Lim (1997), Cororaton et al (1996), Cororaton & Abdula (1998), and Cororaton & Caparas (1998).

Recent research results also indicate that TFP has not improved. Austria (1998), using a macro-dynamic model with output and inflation interaction, showed that the TFP for the period between 1960 and 1997 declined by 0.4 percent (Table 3). There are, however, variations in the TFP estimates within sub-periods, with TFP positive in a few sub-periods and negative in others. But, on the average, it is negative. Lim (1998), using a Cobb-Douglas production function showed negative TFP for industry and services, sectors which account for 75 percent of GDP. The results of Cororaton and Caparas (1998) also showed negative TFP for the entire economy during the period between 1980 and 1996. Using different TFP methodologies and different time periods for the database, Cororaton and Caparas (1998) and Cororaton and Abdula (1997) showed positive TFP for the manufacturing sector. However, in Cororaton et al (1996) the *number* of manufacturing industries in the manufacturing sector with negative TFP increased from 1956 to 1992, while the average TFP for the entire manufacturing sector is slightly above zero. The reason for this is that the TFP for the food manufacturing industry, which captures a big share of the whole manufacturing sector, is positive, while the *number* of smaller manufacturing industries with negative TFP increased during the period.

C. Factors Affecting TFP : Empirical Results

The movements of TFP could be due to various factors. There are two studies which attempted to conduct regression analysis to examine some possible determinants of TFP in the Philippines. The results of Austria (1997) and Cororaton and Abdula (1997) are shown in Tables 4 and 5, respectively. The first considered TFP of the entire economy as the dependent variable in the regression, while the second TFP of the manufacturing sector.

In Austria, TFP of the entire economy was regressed against trade and investment policy indicators. The indicators include tariff rates, share of exports to GDP, share of imports to GDP, foreign direct investments (FDI), and inflation.

Both tariff and import share are used to capture the trade liberalization program of the government through the reduction in tariff and non-tariff barriers. FDI is one of the major vehicles for transferring technology from abroad, thus its inclusion in the analysis would attempt to capture transfer of technology. Inflation is a “catch-all” indicator of economic stability. High inflation means macroeconomic instability. Normally, economic instability discourages productivity-enhancing programs from being adopted (like R&D) and investment.

The regression results show a statistically significant effect of exports on TFP growth (see Table 4). The two major exports of the Philippines are semi-conductors which account more than 60 percent of total merchandise exports. These exports are highly import dependent in terms of raw materials and technology. In fact, these exports are closely tied up to the foreigner buyers through consignment. Thus the growth in exports could be also a vehicle of technology transfer.

Contrary to the general expectation, imports have a negative effect of TFP. According to Austria (1997) there are two possible explanations for this. First, in the regression, total imports were considered. Imports of machinery and equipment, which usually embody new production techniques and technology, are only a fraction of the total. Thus, the inclusion of the total imports might have captured other effects also. Second, unavailability of skilled workers who can adequately operate the new machines and equipment might have led to their inefficient use, thus causing lower productivity.

Tariff rate has a negative effect on TFP, although the coefficient is not statistically significant. Effective rate of protection (EPR) could have been the more appropriate indicator of tariff liberalization, but time series on EPR is not available. However, Austria (1997) cited other studies which showed that when protection is reduced at a moderate rate, the rise in productivity is highest; and

when protection is reduced at an excessively fast rate or when it is not reduced at all, the rise in productivity is lowest.

Foreign direct investments (FDI) have positive effect in one of the estimated equations but are not statistically significant (Equation 1 in Table 4) . While it may take some time before FDI brings about productivity effects, the result of incorporating a one-year lag in FDI yields a positive effect, (Equation 2). However, the effect of including both total FDI and FDI in manufacturing shows a significant positive effect of total FDI on TFP growth, but a significant negative effect of FDI in manufacturing (Equation 3). Austria (1997) attempted to explain the negative effect of manufacturing FDI by citing the fact that multinational companies are oriented towards the global market, thus there may be less room for adaptation of technology to the local economy in a wide scale manner.

Table 4: Determinants of Total Factor Productivity, 1960-1996

Dependent Variable: TFP Growth of Philippine Economy	Equation (1)	Equation (2)	Equation (3)
Constant	-0.016 (-0.69)	-0.018 (-0.76)	0.034 (0.53)
Share of Exports to GDP	0.005 (3.41)*	0.005 (3.31)*	0.008 (2.41)**
Share of Imports to GDP	-0.003 (-2.27)**	-0.002 (-1.99)***	-0.004 (-3.46)*
Tariff rate	-0.83E-04 (-0.07)	-0.015E-03 (-0.13)	-0.002 (-0.99)
Inflation rate	-0.002 (-4.62)*	-0.002 (-4.91)*	-0.002 (-5.46)*
Foreign Direct Investment (FDI)	0.12E-05 (1.26)		0.33E-05 (2.14)
FDI _{t-1}		0.11E-05 (1.01)	
FDI in Manufacturing			-0.11E-05 (-1.85)**
DW Statistics	1.94	1.89	2.09
Adjusted R ²	0.53	0.52	0.67

Note: t-values are in (). *, **, and *** indicate significance at 1, 5, 10 percent levels, respectively. Source: Austria (1997).

Lastly, inflation, which is a catch-all variable of macroeconomic instability, has a significant negative effect on TFP.

In a similar exercise, Cororaton and Abdula (1997) conducted a regression analyzing some possible factors affecting manufacturing TFP. The factors included in the analysis were: estimated TFP of the manufacturing sector; exports; imports; tariff; minimum wages; R&D; foreign direct investment; and inflation. The variables entered the analysis either as ratios to GDP or in first difference or both.

All estimated coefficients are statistically significant (see Table 5). Exports ratio is positively affecting TFP of manufacturing. The reason discussed above with regard to export may apply here also, i.e., exports could be one channel through which foreign technology is transferred to the local economy. This is because of the close tie-up with the major exporters in the Philippines with the foreign direct buyers. However, similar to the previous results, the same negative effect of imports on TFP manufacturing is seen in the result.⁴

Table 5: Determinants of TFP Growth in Manufacturing

Dependent Variable: TFP Growth of Manufacturing	Results: Coefficients and Test of Significance
Constant	5.316 (27.267)
Exports(-1)	0.148 (8.581)
Imports(-1)	-0.519 (-18.522)
D(Tariff)	-1.740 (-33.438)
Wage	-0.126 (-9.353)
DRD(-1)	0.101 (9.353)
FDI(-2)	0.005 (-14.081)
INF	-0.153 (-14.081)
INF(-1)	-0.468 (-23.088)
Adjusted R2 = 0.997 DW = 0.65 F-Stat = 448.63	D(tariff): period differential of average nominal tariff rates Wage: growth of research and development expenditure as % of GDP, lagged one period FDI(-2): foreign direct investment INF: inflation INF(-1): Inflation, lagged one period
Where: Exports(-1): real growth of exports, lagged one period Imports(-1): real growth of imports, lagged one period	

Source: Cororaton and Abdula (1997)
t-values are in ().

⁴ The negative coefficient showed up when capital imports was included in the regression instead of total imports. Although the reason behind this may be unclear, the authors would attribute this to the inappropriateness of technology adopted by industries. Such technology which functions merely as inputs, entails no significant effect on domestic science and technology (Yap, 1989).

Tariff has negative effects on manufacturing TFP. This would imply that a reduction in the tariff protection would result in productivity improvement (probably due to efficiency gain from a competitive environment). FDI has a significant positive effect on TFP.

Minimum wage, usually wage rate for unskilled labor, in the Philippines is legislated. The results show that an increase in minimum real wage decreases productivity, which is generally expected. Usually, a wage system which is not based on productivity is inefficient. Inflation, an indicator of economic instability, negatively affects productivity. High inflation occurs in an economic system with lots of uncertainty. This prevents organization from pursuing productivity-enhancing programs.

R&D as a percent of GDP has a positive effect on TFP. This has an important policy implication because, usually, technological change cannot be realized without technological infrastructure. Furthermore, the effectiveness of technology transfer requires distinct activities and investments and the level technological development of the country to minimize the cost of implementing the new technology and to maximize its productivity once in place. Normally, the technological development of a country depends upon R&D investments and on the efficiency of its R&D institutional system. There is an ongoing study⁵ in the Philippines which looks into the country's R&D expenditure patterns and effectiveness of its organization system. The last section will discuss very briefly some of the preliminary findings.

II. The National Policy Agenda for TFP : Overview

The preceding review of empirical work is instructive in formulating TFP policies for the Philippines. This section seeks to further situate the policy

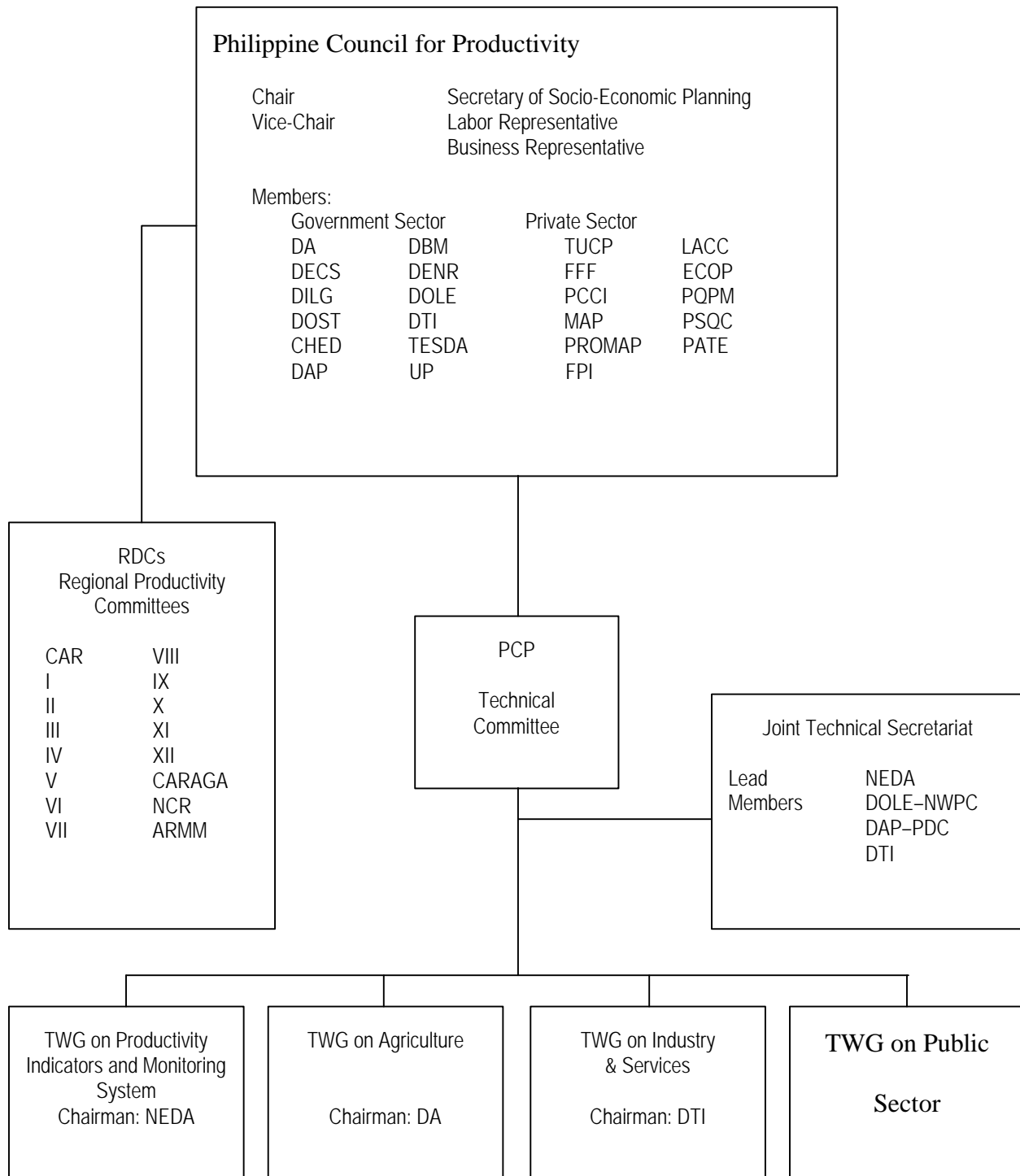
⁵An ongoing research of the Philippine Institute for Development Studies on the "Study on Public and Private Expenditures on Research and Development". The study is funded by the

implications of these studies in the framework of policy intervention in the Philippines as contained in the document *National Action Agenda for Productivity (NAAP)*. The NAAP was formulated by a multi-sectoral group and was launched in January, 1997. The plan serves as the official blue-print for public and private sector interventions to improve TFP.

Policy measures in the NAAP are derived from theoretical growth models as well as those suggested by empirical work. Policies on technological change and TFP came to the fore with the emergence of the neo-classical growth model which is premised on constant or diminishing returns to scale in the use of inputs. Technological progress is important since diminishing returns can undermine a growth process that relies heavily on resource expansion. New growth theories, on the other hand, emphasize efficiency improvements from increasing returns to scale and the role of education and other human-capital enhancing policies.

The NAAP framework takes the whole economy as an area of policy intervention, albeit the latter comes in different forms and extent of application. However, the framework proceeds from the recognition that the economy cannot be described by a single production function; that is, production sectors are not homogenous. Thus, it disaggregates the Philippine economy into three: agriculture, industry and services and the public sector. Further within agriculture, major sub-sectors are identified. The broad framework shown in Figure 2 thus appears to accommodate both growth models since some sectors are closer to the neo-classical assumption while others to the new growth model assumptions.

Figure 2
PHILIPPINE COUNCIL FOR PRODUCTIVITY
ORGANIZATIONAL STRUCTURE



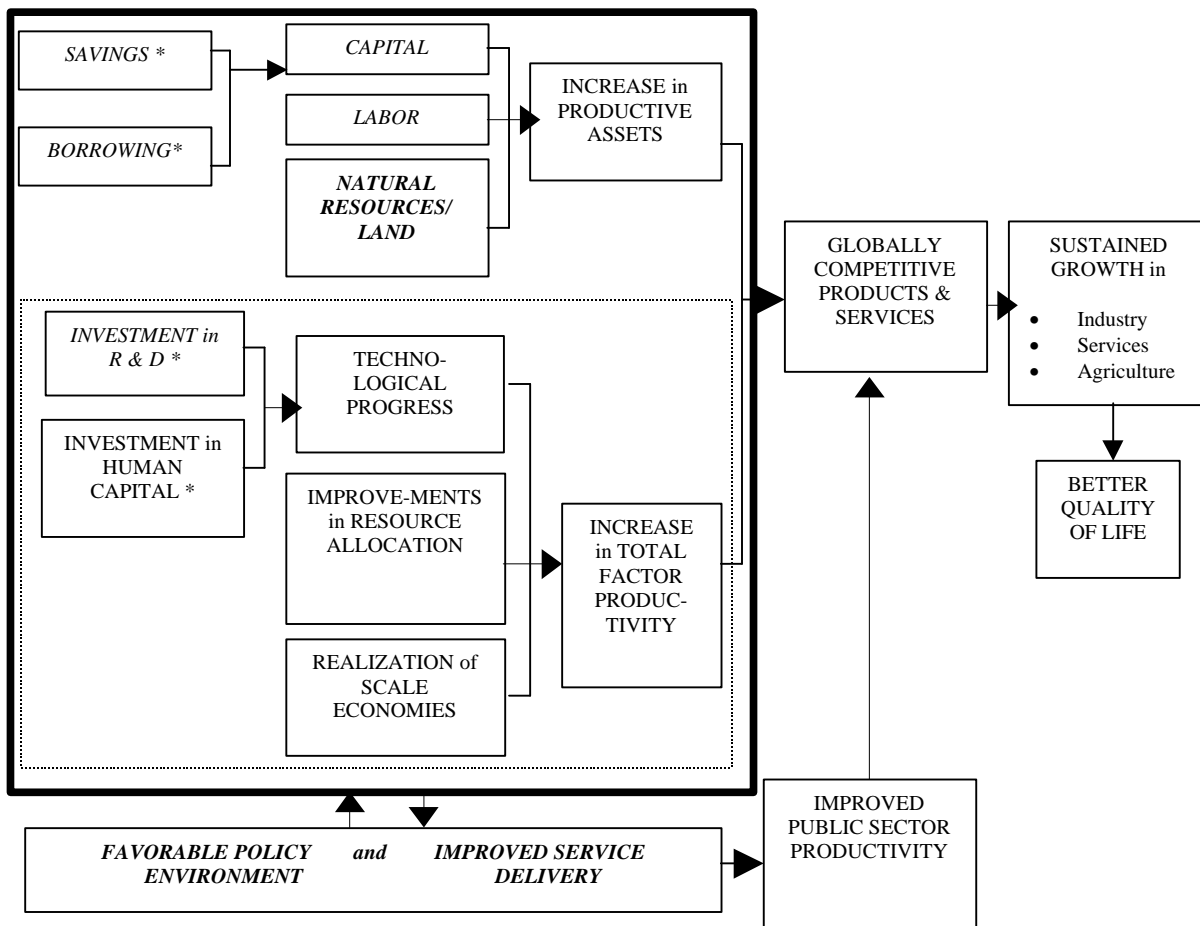
* PCP Resolution No. 4, dated 25 November 1997; Amendment to AO 267 transferring the Chairmanship of the TWG from DBM to CSC has been submitted to the President for approval.

Figure 2 Annex

DA	Department of Agriculture
DECS	Department of Education, Culture and Sports
DILG	Department of Interior and Local Government
DOST	Department of Science and Technology
CHED	Commission on Higher Education
DAP	Development Academy of the Philippines
DBM	Department of Budget and Management
DENR	Department of Environment and Natural Resources
DOLE	Department of Labor and Employment
DTI	Department of Trade and Industry
TESDA	Technical Education and Skills Development Authority
UP	University of the Philippines
TUCP	Trade Union Congress of the Philippines
FFF	Federation of Free Farmers
PCCI	Philippine Chamber of Commerce and Industry
MAP	Management Association of the Philippines
PROMAP	Productivity Management of the Philippines
FPI	Federation of Philippine Industries
LACC	Labor Advisory and Consultative Council
ECOP	Employers Confederation of the Philippines
PQPM	Philippine Quality and Productivity Movement
PSQC	Philippine Society for Quality Control
PATE	Philippine Association for Technological Education
NWPC	National Wages and Productivity Commission
CSC	Civil Service Commission

The framework gives importance to policies that address both resource constraints and productivity in improving domestic production. The upper left box in Figure 3 emphasizes the resource component considering that there are still infrastructure, skilled labor and other input constraints in most sectors. The lower left box of the same diagram places the role of TFP policies or those policies that enhance or facilitate technological progress; improvements in resource allocation such as the greater use of prices through deregulation; and market expansion and industrial organization policies that will show up in the realization of scale economies.

Figure 3.
Sustained Socio-Economic Growth Through Productivity
Framework for the National Action Agenda for Productivity



* *Examples*

The aggregate growth models have no explicit role for government. The NAAP, however, is premised otherwise considering that governance issues are believed to have significant implications on resource allocations. For instance, the cost of transacting business can easily be inflated by delays in processing registrations and various regulatory requirements. Thus, a practical component of the public sector TFP policy is to shift from manual to computer-based processing which involves lesser paper work requirements of transactions ranging from those of the Board of Investments to the issuance of birth certificates by the National Statistics Office. Further, the government continues to provide basic services such as health and education which are also wanting of efficiency improvements. The NAAP, however, recognizes in the medium-term, efficiency gains can be achieved by privatizing services which are better delivered by the private sector.

The pronounced objectives of TFP policies in the NAAP are three-fold. The first of these is to generate globally competitive products and services. The international market is important for the Philippines in view of its relatively small domestic market which can limit the realization of scale economies. The role of complementary policies, both macroeconomic and sectoral are, of course, important in coming up with price and quality competitive products. It may also be that these (macroeconomic) policies aimed at expanding markets are the ones that drive TFP improvement. Indeed, Tables 4 and 5 suggest that TFP over the period 1990-1996 has been alleviated by increases in the export to GDP ratio. The deregulation and liberalization of the domestic sectors which will allow competition from FDIs is therefore a beneficial policy component of the NAAP⁶. Tariff rate reductions consistent with the commitment to the ASEAN Free Trade Area (AFTA) to have a 0-5 percent tariff rate is now being implemented. Macro stability is also important; hence, government has targeted lower public sector deficits (and surpluses for some years) over the next medium-term.

⁶ Note that FDI per se may have a doubtful effect on TFP as discussed earlier.

Second, the production of globally competitive products and services is expected to sustain the growth of the country's three major sectors. The modernization of agriculture which can come with technological progress is planned to bring about the transformation of the sector as the largest employer in the country. With higher productivity, agriculture is expected to release manpower for industrial production. The economy over the long-term is envisioned to industrialize while agriculture will contribute a lower share to GDP even as its productivity improves.

To address the transformation, a key component of the NAAP is the accelerated provision of infrastructure (e.g., irrigation) by government as well as market incentives for the acquisition of farm machinery and investments in R & D. (Section III below discusses in detail issues related to R&D, including those for other sectors.) Taking off from the suggestions of empirical studies, a key complementary policy is skills strengthening through greater provision of quality basic education – the NAAP specifically focuses on the establishment of mathematics and science and technology schools in every province – as well as re-tooling programs for those already in the work force.

Finally, higher TFP is expected to lead to higher production (and higher income) per capita, thus contributing to the long-term target for the Philippines to reduce absolute poverty by 2025.

III. Research and Development (R&D) in the Philippines: Some Institutional Issues

Cororaton (1998) conducted a review of literature concerning R&D in the Philippines. This section reviews some of the major issues raised.

A. Low R&D Effort in the Philippines

The common indicators of R&D effort are the ratio of R&D expenditure to GNP and the number of R&D scientists and engineers per million population. As shown in Table 6, the current level of R&D effort in the Philippines is low relative to other countries. In fact, out of 91 countries surveyed, the rank of the Philippines is at the lower end. In terms of number of scientists and engineers per million of population, the country is 73rd out of 91 countries, its ratio being 152. In terms of gross expenditure in R&D to GNP ratio, it takes the 60th place, its ratio being 0.2 percent.

Table 6: Indicators of R&D Effort: The Philippines

Variables	Maximum	Minimum	Philippines' Rank	Philippines' Level
Per Capita GNP (US\$, 1994)	34,630	80	68 th	950
Scientists and Engineering per million population	6,736	8	73 rd	152*
Gross expenditure in R&D/GNP (%)	3	0	60 th	0.2*

* 1992 level

Source: UNESCO

The low level of R&D personnel is the result of the country's educational system that produces very low science and engineering-related graduates (Table 7). While students at the tertiary level is high in the Philippines, the number of tertiary students taking up science and engineering-related courses is low. There is in fact a dilemma in the present education system because of the education "mismatch". While there is a great demand for technical and engineering-related graduates by the local industries, private tertiary schools, which dominate the tertiary level, continue to produce non-technical graduates. One of the arguments used to explain this is that private schools prefer not to go into these courses because of the high laboratory requirement which is capital intensive. Non-technical courses are less laboratory intensive and therefore less capital intensive.

This has two important implications: (1) low R&D means low productivity as established above; and (2) underinvestment is economically costly because the returns to R&D investment could be high.

Table 7: Tertiary Education Across Selected Pacific Rim Countries

Country	(1)	(2)	(3)	(4)	(5)	(6)
China (1991)	2,124,121	0.17	80,459	3.79	59,748	74.26
Japan (1989)	2,683,035	2.13	85,263	3.18	54,167	63.53
South Korea (1991)	1,723,886	3.83	92,599	5.37	28,479	30.76
Australia (1991)	534,538	2.92	92,903	17.38	26,876	28.93
Singapore (1983)	35,192	1.13	1,869	5.31	532	28.46
Malaysia (1990)	121,412	0.58	4,981	4.1	1,251	25.12
Thailand (1989)	765,395	1.24	21,044	2.75	4,928	23.42
New Zealand (1991)	136,332	3.78	13,792	10.12	2,863	20.76
Philippines (1991)	1,656,815	2.39	63,794	3.85	5,520	8.65

Column Definition:

- (1) : Number of students at tertiary level
- (2) : Number tertiary students as percent of population
- (3) : Number of post-baccalaureate students
- (4) : Post-baccalaureate as % of Tertiary Students
- (5) : Number of post-baccalaureate science & engineering students
- (6) : Post-baccalaureate science & engineering as percent of post-baccalaureate students

Source: Basic source of data UNESCO World Science Report (1996).

Evenson and Westphal (1995) survey results of 156 studies estimating rates of return to R&D investments in agriculture and 40 studies in industries and found that, indeed, the rates are very high, even higher than the other forms of investment like infrastructure (Table 8). The results show that of the public agricultural research, more than half of the studies surveyed show rates of return higher than 50 percent. Only a few studies show estimated rates of return lower than 10 percent. It is also worth noting that in terms of the distribution of estimated returns, developing countries have higher estimated rates compared to developed countries. There are relatively fewer studies reporting rates of return to private sector R&D used in agriculture, but again the estimated rates of return are also high.

Fewer studies report the estimated returns to industrial R&D in developing countries. But the results presented in the table show that industrial R&D

investments do have similarly high rates of return. In the Philippines, the study of Pack (1987, 1990), which focused on the computed potential returns from productivity enhancing expenditures on adaptive modifications and skills development in a sample of Philippine textile firms, indicate that more than 80 percent of the firms in the industry would realize higher returns from such expenditures than from alternative investments.

Table 8: Estimated Rates of Return to R&D

	No. of Studies	Estimate not Significant	Range of Estimates				Mean
			1-24	25-49	50-75	75+	
Public Sector Agriculture Research							
Africa	10	1	2	3	3	1	41
Latin America	36	2	14	22	13	13	46
Asia	35	2	7	20	23	25	56
All Developing Countries	85	5	23	45	40	44	80
All Developed Countries	71	5	21	54	26	29	48
Private Sector Industrial Research							
Developing Countries	5	0	0	3	3	2	58
Developed Countries	35	0	10	20	10	5	44
Public Sector Agriculture Extension							
Developing Countries	17	1	4	2	4	6	50
Developed Countries	6	0	1	0	3	2	63

Source: Evenson and Westphal (1995)

B. Other important institutional issues

The two reasons why S&T/R&D policies in the Philippines suffered major setback are as follows: (i) underutilization of S&T for development; and (ii) weak linkage between technology generation, adaptation and use.

Underutilization is reflected in the underinvestment in S&T/R&D in terms of manpower training, technological servicing, R&D facilities and financial resources. The weak linkage can be attributed to the following factors: (1) poor linkage between technology generation, adaptation and use; (2) slow commercialization of technologies due to weak delivery system; (3) poor linkages

of S&T organizations with industry and other government agencies; (4) low appreciation of R&D due to short-term perspective of private and government agencies.

At this juncture, it is important to mention the study of Eclar (1991) which attempted to investigate some of factors that may be important in improving the delivery system and commercialization. The study identified user participation. Successful commercialization is promoted when a user with a specific need has been identified at the start of the project. The user generally maintains an interest in the progress of the research and takes on the commercialization of the results at the completion of the research project in order to meet his earlier expressed need. This is reinforced when the user's interest in the project is translated into support or cost-sharing.

Another important factor is pilot testing. Demonstration of the technical viability of the technology in a semi-commercial scale helps convince an industry user to start-off the commercialization process. Commercial success is promoted when the user himself has provided material inputs to the pilot test.

At a more macro level, despite the expressed importance of S&T and R&D development in the Philippines and the series of well-intentioned strategies, the state of S&T and R&D development remains far behind other Asian countries by any measure. One reason behind this is the low private sector participation in R&D activities. Most countries which achieved a healthy partnership between public and private sectors in R&D had higher investments in R&D. The bulk of R&D expenditure that originates from the private sector in Japan is 83 percent, Korea 82 percent, Taiwan 65 percent, Singapore 62 percent, Thailand 40 percent. In the Philippines, the estimated share of the private sector remains at 20 percent.

The present government's thrust in promoting S&T and R&D is stated in the Science and Technology Agenda for National Development (STAND Philippines 2000). This document embodies the country's technology development plan in the medium term. STAND identified 21 priority areas. These priority areas include 7 export winners, 11 domestic needs, and 3 supporting and coconut industries.⁷

STAND 2000 have too many identified areas to be supported with too little financial resources and budget. It is highly doubtful as to how much attention was given to the consideration of the viability of its implementation. There is seemingly a weak linkage between planning and budgeting, and little consideration of budget availability in the plan formulation stage.

⁷ The export winners are computer software; fashion accessories; gifts, toys and houseware; marine products; metal fabrications; furniture; and dried fruits. The domestic needs include: food; housing; health; clothing; transportation; communication; disaster mitigation; defense; environment; manpower; and development energy. The support industries are: packaging; chemicals; and metals. In addition, special focus is given to the coconut industry.

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