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Development of Regional Production and Logistic Networks in East Asia: The Case of the Philippines*

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Abstract

Regional production networks and local production linkages are important not only for the generation of industrial activity through investment flows but also as essential sources of new information and technology. Complementing this are the so-called knowledge networks within or around industrial agglomerations that are equally important sources of technology for industrial upgrading and innovation. Both are present in the case study area of CALABARZON in the Philippines but the former seem to be more apparent than the latter as this has been characterized as weak based on secondary data and conduct of survey of establishments. With weaknesses in the S&T system in the country as part of the study's findings, policy suggestions were provided to strengthen the linkages that remain to be wanting but are important for stimulating innovation.

INTRODUCTION

The effort towards deepening regional economic integration in ASEAN is a work-in-progress. The vision of one ASEAN Community guides the economic, security and socio-cultural endeavours of ASEAN from when the Bali declaration was made in 2003 to when the timeline was accelerated in Kuala Lumpur in 2006 and affirmed in Cebu in 2007, for the establishment of the ASEAN Community by 2015. The Roadmap for an ASEAN Community that would take into effect from 2009 to 2015 was a highlight of the recently concluded 14th ASEAN Summit in Cha-am Hua Hin, Thailand in February 2009. The establishment of an ASEAN Economic Community (AEC) by 2015 is aimed

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at liberalizing and facilitating the flows of investment in order to attract foreign direct investments (FDIs) and deepen the region's participation in production networks. It may be recalled that Southeast Asia has become the production workhorse for the world including more developed economies in East Asia through the provision of foreign direct investments. Aldaba and Yap (2009) state in their most recent work that the regional production networks are at the heart of intraregional trade and investment flows within ASEAN and responsible for the latter's integration with East Asia. These are also claimed to be the key drivers of economic growth in ASEAN. The AEC blueprint calls for the strengthening of the existing ASEAN Investment Area into a more rigorous ASEAN Comprehensive Investment Agreement that would be based on the four major pillars of liberalization, protection, facilitation, and promotion. Under the latter, the general aim is to promote ASEAN as an integrated investment area and production network by creating the environment conducive to all forms of investments and creation of new growth areas (Aldaba and Yap, 2009).

The industrial clusters existing in the region are the spokes of multinational companies as well as hubs of domestic firms, particularly those engaged in manufacturing. The Eastern Seaboard region of Bangkok in Thailand is host to the automotive cluster, while JABODETABEK is the manufacturing center of Indonesia. In the Philippines, the CALABARZON region is where the major manufacturing activities in the nation are located and has established itself as a regional cluster for such. While these industrial clusters attract investments in their respective economies, they also serve as the channels where increasing flows of investments, industrial complementation and logistics networks may be directed to and subsequently, deepen economic integration via the regional production networks. This would lead closer to the envisioned one ASEAN Economic Community.

It is thus, imperative that these industrial clusters become increasingly competitive and more productive to be more relevant and able to latch onto the regional production networks. The argument coming from the so called new economic geography school highlights the role of industrial agglomeration to economic growth. Indeed, the agglomeration effects that attract firms to locate in these special locations could also be the reasons why industrial clusters are drivers of growths in the sub-national sphere and even, the national scale. The Marshallian externalities of economies of scale; availability of specialized input services; highly specialized labor force; circulation of new ideas, arising from the accumulation of human capital and face-to-face communications; and presence of necessary physical infrastructure are said to be in effect in industry agglomerations. Experts denote that knowledge spillovers do emerge in industrial clusters with some empirically proving this through various indicators of knowledge (Feldman, 2000). Knowledge is the source of innovative ideas that when applied to production can lead to introduction of a new good or product; introduction of a new method of production; opening of a new market; engaging a new source of raw materials; and carrying out new organization or management systems. Even ASEAN member economies put faith in the importance of Science and Technology (S&T) for ensuring that ASEAN remains globally competitive, which can be done by continuously moving up the technology ladder and "enhancing their capability for technological innovation in many areas." While S&T is the more general, abstract concept, research and development or R&D is the mechanism by which innovation can be applied.

This paper, which is part of a multi-country study under the auspices of the Economic Research Institute for ASEAN and East Asia (ERIA) looks into the status of innovative activities in Philippine firms, if agglomeration and production networks are factors for sourcing out new information and technological knowledge. The literature on industry clusters point to collaborative activities among cluster participants that are not confined among the firms in the specific location but encompassing other firms, institutions and agencies in the geographic proximity of the production area, as the real definition of clustering. This provides the possibility of looking at the research institutes and universities in the area as possible sources of information and new ideas by firms in the cluster. These research institutes and educational institutions, whether public or private, can be called knowledge networks and could likewise be a source of knowledge spillovers or exchanges. The paper would look into this in order to determine the sources of technology and innovation of Philippine firms and what sorts of linkages are in place to ensure that innovation takes place. Such types of linkages may be in the form of direct technology transfers that happen when FDIs flow into the country characterizing the operations of particular establishments. Also, technology licensing arrangements or purchase of technology, engaging the services of consultants, and contract research to experts are some of the typical arrangements or channels for sourcing out technologies and information. In addition, university-industry linkages, pervasive in developed countries, include such activities as internship/practicum arrangements, contract research directly with faculty members or through the university, incubation laboratories, technical cooperation, licensing of technology, and participation in research consortia. There are times that spin-offs or start ups are established arising from technology developed and involving the need for venture capital in order to commercialize inventions.

The first section provides a brief history of the evolution of industrial development in the Philippines, followed by a chapter on the state of its innovation system. The third and fourth chapters are the heart of this paper as they focus on CALABARZON as the study's test case in finding out the linkages involved as sources of innovative ideas. The third section provides a profile of the study region while the next, presents the results of the survey of manufacturing establishments from a sample of firms in CALABARZON. The final chapter summarizes the findings of the study and provides policy suggestions.

1. INDUSTRIAL DEVELOPMENT IN THE PHILIPPINES

1.1. Economic Structure

The Philippines' economic structure has been dominated by the services sector for years. From Table 1 below, it can be gleaned that since 2001, the services sector has been accounting for nearly 50 percent of total output for the Philippines, while the industry sector has been hovering at the 32 to 34 percent range. The agriculture sector accounted for between 18 to 19 percent annually from the period 2001 to 2008 (Yap, 2009). Figures from the Asian Development Bank (ADB) however, put the percentage share of services output at more than 50 percent since 1998 and reaching 53 percent from 2001 to 2004 before accounting for 54 percent of total annual output from 2005 to 2007. While the trend for industry output is similar to the Philippine official figures, the ones for agriculture output show steady decline in ADB estimates and at a lower figure of 14 to 15 percent in the period 2001 to 2007 (ADB, 2008).

Table I. Selected Macroeconomic Indicators, Philippines
Annual Growth Rates and Share to GDP
At Constant 1985 Prices, In percent unless otherwise stated

	2001	2002	2003	2004	2005	2006	2007	2008
Gross National Product	2.26	4.31	5.82	6.91	5.33	6.10	7.80	6.1
Gross Domestic Product	2.96	3.12	5.04	6.38	4.87	5.45	7.33	4.5
Agriculture, Fishery and Forestry	3.69	3.80	3.92	5.18	2.02	3.83	5.08	3.2
(share to GDP)	*19.92*	*20.05*	*19.84*	*19.62*	*19.08*	*18.79*	*18.39*	*18.1*
Agriculture and fishery	3.92	3.97	3.85	4.98	2.01	3.87	5.04	3.2
	19.82	*19.99*	*19.76*	*19.50*	*18.97*	*18.69*	*18.29*	*18.0*
Forestry	(27.26)	(30.16)	24.10	53.29	4.15	(3.91)	12.13	2.3
	0.10	*0.07*	*0.08*	*0.11*	*0.11*	*0.10*	*0.11*	*0.1*
Industry Sector	0.91	0.15	4.25	5.21	3.78	4.55	6.61	5.0
(share to GDP)	*34.76*	*33.75*	*33.50*	*33.13*	*32.79*	*32.51*	*32.29*	*32.7*
Mining and quarrying	(6.54)	50.96	16.82	2.62	9.32	(6.09)	25.01	0.6
	1.01	*1.48*	*1.65*	*1.59*	*1.65*	*1.47*	*1.72*	*1.7*
Manufacturing	2.87	3.47	4.24	5.84	5.28	4.60	3.34	4.3
	24.37	*24.45*	*24.26*	*24.14*	*24.23*	*24.04*	*23.14*	*23.1*
Construction	(4.96)	(23.72)	0.96	3.41	(5.88)	7.33	19.49	8.2
	6.11	*4.52*	*4.34*	*4.22*	*3.79*	*3.86*	*4.29*	*4.7*
Electricity, Gas and Water	0.67	4.26	3.19	4.23	2.48	6.39	7.21	7.7
	3.27	*3.31*	*3.25*	*3.18*	*3.11*	*3.14*	*3.14*	*3.2*
Service Sector	4.25	5.10	6.11	7.73	6.81	6.70	8.68	4.9
(share to GDP)	*45.32*	*46.19*	*46.66*	*47.25*	*48.13*	*48.70*	*49.32*	*49.2*
Transport, communication and storage	8.81	8.93	8.59	11.23	7.34	6.34	8.23	3.7
	7.41	*7.82*	*8.09*	*8.46*	*8.65*	*8.73*	*8.80*	*8.7*
Trade	5.61	5.76	5.66	6.78	5.64	6.10	9.80	4.7
	16.12	*16.53*	*16.63*	*16.69*	*16.82*	*16.92*	*17.31*	*17.1*
Finance	1.23	3.44	5.88	9.88	13.61	11.36	12.26	4.9
	4.72	*4.74*	*4.77*	*4.93*	*5.34*	*5.64*	*5.90*	*6.0*
Ownership of dwellings and real estate	(0.45)	1.72	4.10	5.30	5.32	5.71	6.02	7.0
	4.80	*4.74*	*4.70*	*4.65*	*4.67*	*4.68*	*4.62*	*4.7*
Private services	4.40	5.49	8.12	10.65	7.52	6.92	8.76	5.7
	7.38	*7.55*	*7.78*	*8.09*	*8.29*	*8.41*	*8.52*	*8.6*
Government services	0.94	1.46	2.70	0.49	2.96	4.71	3.29	4.7
	4.88	*4.81*	*4.70*	*4.44*	*4.36*	*4.33*	*4.16*	*4.1*

Source: National Accounts of the Philippines, National Statistical Coordination Board;
Selected Philippine Economic Indicators, Bangko Sentral ng Pilipinas; National Statistics Office
As derived from Yap, 2009

Employment is likewise cornered by the services sector with almost 49 percent of total employment in 2007 attributed to it. The agriculture sector was the second biggest employer during the same period, accounting for 36 percent of employment. The industry sector's share in 2007 was 15 percent (NSO, 2009).

Being the second most importance source of output of the Philippine economy and continued recipient of FDIs, the industry sector remain to be relevant and continues to be a target of policy interventions to ensure its stability, its capability to generate employment opportunities and to improve its productivity in order to enhance its contribution to economic growth.

1.2. Industrial Policy

During the post-war period up to the 1970s, the Philippine economy had been characterized as highly trade restrictive and protectionist that supported an inward-looking, import-substitution era. This protectionist regime did not prepare the country for the political turmoil that rocked the entire economy in the 1980s causing a contraction of the economic growth rate in 1984 to 1985. The institution of critical reforms occurred in line with the fresh mandate given by the Filipinos for a more democratic system of governance. Economic reforms that took place in the late 1980s and through the 1990s and the present decade helped the economy bounce back to the point that investments, both local and foreign, poured in starting the 1990s.

In line with the era of globalization, official policy in the country shifted from inward-looking, import substitution strategy into an outward-oriented, export-promotion regime. These structural adjustments actually started in the early 80s with first Tariff Reform Program (TRP-1) implemented in 1981. TRP-1 reduced the tariff rates to within the 0 to 50 percent range. The subsequent Tariff Reform Programs from the 1990s to 2000s helped liberalize the trade environment, improved access to essential inputs, made available more choices for consumers, simplified the tariff structure, and enhanced competitiveness of local industries. These efforts are not at all inconsistent with the international commitments of the Philippines, both at the regional and World Trade Organization levels.

Deregulation, liberalization and privatization took effort in 1994 onwards. These policies are aligned with the objectives of facilitating economic openness, divestment of inefficiently run government owned enterprises and removal of the hold of monopolies in vital sectors of the economy. The first to open up was the banking sector with the passage of the Foreign Act Liberalization Act authorizing the entry of 10 foreign banks in the country. This was followed by a flurry of legislation liberalizing the telecommunications and water sectors. In 1995, the Public Telecommunications Policy Act of the Philippines reduced the monopoly hold of the Philippine Long Distance Telephone Company on the national telecommunications sector and paved the way for the entry of other players that have now, challenged the dominant position of the former, including in mobile telephony and internet services provision. The National Water Crisis Act caused the privatization of the state-run water facilities and has now enabled the provision of water services by private companies, especially in Metro Manila. In 2001, the energy sector was the beneficiary of the Electric Power Industry Reform Act that called for key reforms that would improve the provision of electricity to consumers.

In 1991, the Foreign Investments Act was enacted into law allowing more liberal policies for the entry of foreign inflows into the country. It allowed foreign equity participation of up to 100 percent in many areas, except those under the Foreign Investment Negative List (FINL). In subsequent years, the FINL was significantly reduced, all aimed at attracting foreign direct investments (FDIs). The General Banking Act of 2000 further facilitated deepened operations of foreign banks, while the Retail Trade Liberalization Act opened the industry to foreign players. The Omnibus Investments Code of 1987 complemented all these liberalization and deregulation efforts as it provides for incentives applicable to both Filipino-owned and foreign-owned investments. Specifically, the Code offers fiscal and non-fiscal incentives to preferred areas of investments and activities as reflected in the annual Investment Priorities Program (IPP). Typically, R&D activities always fall under the preferred activities of the IPP.

The industrialization dispersal policy that was rooted in the creation of export processing zones in 1972 also experienced institutional and structural transformation when it was replaced by the Special Economic Zone Act of 1995. While the former was geared more towards hosting firms that cater to the export market alone, the latter was more explicit in its goals of accelerating a sound and balanced industrial, economic and social development of the country through the establishment of special economic zones, in various forms, in strategic locations aimed at attracting investments to these jurisdictions. The focus was veered away from government-run institutions and structures, to privately initiated and managed industrial zones. In fact, there are only five public economic zones in the country today, while there are 174 private industrial zones. At the moment, there are two other special economic zones in Luzon that were the offshoot of the exit of US military presence in the country. The Subic Bay Freeport Zone and the Clark Freeport Zone have been transformed from military bases to investment havens and ran by government corporations.

While industry clustering as a strategy for industrial development has already gained ground in other countries, the Philippines started to look at clustering as a paradigm for revitalizing industries in 2002. It was a key element of the Philippine Export Development Plan for that year and paved the way for the creation of the National Cluster Management Team (NCMT) under the Export Development Council. The NCMT is monitoring progress of national, regional and provincial clusters. Though late in the game, the Philippines has been implementing the One-Town, One Product (OTOP) Program being spearheaded by the Department of Trade and Industry since 2004. This is aimed at promoting entrepreneurship and job creation in the countryside. The program supports small and medium enterprises (SMEs) in the production and marketing of distinctive products or services through the utilization of indigenous raw materials, local skills and talents.

The pervasiveness of SMEs in the country's industrial landscape is impossible to ignore as they comprise 99 percent of the total number of manufacturing enterprises and accounted for 47 percent of employment in the sector based on 2003 data[2] (Aldaba, 2008). Experts claim that the growth of the SMEs in the country, starting in the 1980s, can be attributed to the trade liberalization program aggressively pursued during the same period. Combined with the recovery of the economy, the trade liberalization effort helped in doubling the number of manufacturing plants in the mid-1980s while the average number of workers declined "by nearly 40 percent." An indication that SMEs were the ones that emerged during the period (Intal, 1997). Since then, calls for policy interventions to further encourage the growth of SMEs became louder and the response came in the form of "industrial extension" activities.

As early as 2001, the Department of Science and Technology (DOST) has been espousing clustering as a strategy, together with the concept of product niching, as a means of linking S&T to industry policy as elucidated in the National S&T Plan for 2001-2020. This is a clear indication of the acknowledgment of the role of S&T to industrial development via technology transfer and adaptation.

Industry clustering as described in the literature and as implemented in other countries goes beyond mere agglomeration of firms for production purposes but encompasses a slew of collaborative activities, not only among similarly situated firms but including other affiliated firms, research institutions, the academe, public support institutions, local government units, and industry organizations that are located within one geographical location. Joint activities may be in terms of information sharing, standards testing, marketing forays, investments in high risk ventures or purchase of expensive equipment, establishment of common facilities, and R&D. Though this could be emerging in the case of "industry clusters" in the Philippines, such type of collaboration seems to be more evident at the OTOP level, in terms of the active role of local governments and less at the scale of larger firms or major industry types. In her paper on regional development, Tecson (2007) found evidences of limited agglomeration economies in collaborative efforts among clustered producers in the HDD industry. The close interaction between assemblers and suppliers/subcontractors occurred at meetings aimed at ensuring that the latter met the production specifications of the former. She observed that discussions between these parties concerned mainly process modifications and adaptations and there was little interaction for product or technology development. These kinds of interactions limit the knowledge linkages that could result in innovative activities.

Of course, such relationships, between firms and other stakeholders in a cluster, are two-way. The firms are not the only ones expected to reach out to the others, but the other members of the cluster should initiate contact as well. In terms of knowledge exchange in the form of technology transfers and technical support and assistance, the latter route of communication may be driven by the local innovation system in effect.

2. STATE OF THE PHILIPPINE INNOVATION SYSTEM

It is an acknowledged fact that innovation can bring higher productivity and improves competitiveness of firms. In the aggregate, this increases output and leads to economic growth. The application of new knowledge and technology derived from various sources is what enables firms to reduce costs of production, be flexible in producing products that respond to demands, improve quality of products, and upgrade into higher value added production.

There is, however, a technological divide in the global economy, with the existence of highly advanced economies and technologically-backward countries. Choi (1983 as cited in Cororaton, 2002) enumerated factors that have been causing this technology gap between developing countries and more advanced economies: (a) weak policy formulation for scientific and technological development and low public interest on science and development with hostile traditional cultures that pose limits to creation of viable science policy; (b) lack of viable institutional set-ups and inadequate R&D systems where often, research equipment is lacking and research budgets are non-existent and if they do, inefficiently allocated; (c) limited scientific manpower; (d) heavy reliance on imported technology; and, (e) lack of participation of vital sectors in these economies in the development of S&T. The Philippine scenario when it comes to its prevailing innovation system finds commonalities in the above-cited factors, this despite the fact that it has a fairly stable S&T institutional structure.

2.1. The Philippine S&T System[3]

The Bureau of Science during the early American colonial period was the very first S&T organization in the Philippines. It was reorganized into the Institute of Science and was placed under the direction of the Office of the President of the Philippines during independence. However, it was deemed then that it has no capability to support S&T development due to lack of basic information and small budget for its activities. Major shifts in the direction of the country's S&T development occurred in the 1950s and 1960s and focused on institutional capacity-building. Lack of coordination and weak planning capacities still plagued the S&T structure prevailing then. In the 1970s, applied research became the locus of the S&T framework, until research utilization was given emphasis in the 1980s with the creation of the National Science and Technology Authority (NSTA). This reorganization resulted in the creation of the S&T Council System, with the four councils formed responsible for sectoral formulation of policy and programs. These four councils were: the Philippine Council for Health Research and Development (PCHRD); Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD); Philippine Council for Industry and Energy Research and Development (PCIERD); and National Research Council of the Philippines (NRCP). Later on, the NRCP was replaced by the Philippine Council for Aquatic and Marine Research and Development (PCAMRD) and the Philippine Council for Advanced Science and Technology Research and Development (PCASTRD). The NSTA also had eight R&D institutes and support agencies, while regional offices were established to promote S&T and provide extension services. According to Cororaton (2002), the creation of this type of structure signaled the shift in science policy from one characterized by technology push to demand pull strategy. In 1986, the S&T structure was again reorganized, with the NSTA being replaced by the Department of Science & Technology (DOST), a Cabinet-level (or ministerial) government agency. As such, the DOST was mandated to provide central direction, leadership and coordination of all S&T efforts as well as the formulation of plans, policies and programs for S&T development.

In its current configuration, the DOST is comprised of a national office and fifteen regional offices, five sectoral councils (agriculture and forestry, health, aquatic and marine resources, industry and energy, and advanced science and technology), two collegial bodies, seven R&D institutes (industrial technology, nuclear research, forest products, food and nutrition, textile metals, and advanced science and technology), and seven S&T service institutes (delving on science education and training, information database and networks, adoption and commercialization of technology, weather forecasting, and volcanology and seismology). The DOST agencies involved in industrial development are the PCIERD and the Industrial Technology Development Institute (ITDI). The ITDI is one of the research development institutes of the DOST mandated to be its flagship agency for generating technologies and providing technical services to industry. Its R&D activities for generating technologies revolve around seven major areas namely, food processing, materials science, chemicals and minerals, electronics and process control, fuels and energy, microbiology and genetics, and environment. Cross-cutting themes are aimed at deepening the capability of ITDI to address industry and environmental problems in the areas of packaging R&D, national metrology and cleaner production technologies. Performing its other mandate, meanwhile, enables it to serve as the national agency for tests and analyses, and as custodian for weights and measures.

Since 1986, DOST has come up with four S&T frameworks namely, the 10-year S&T Master Plan (STMP); the S&T Agenda for National Development or STAND Philippines, 1993 to 1998; the DOST Medium Term Plan, 1999 to 2004; and, the long-term National S&T Plan, 2002 to 2020. It seems apparent that the framework changes corresponding to the assumption to office of the new President of the country, allowing for flexibility to accommodate the priority thrusts of the sitting administration. However, this does not augur well for a stable and sustainable long term framework for S&T development.

Geared towards massive technology transfer and commercialization, a number of programs has been and are being implemented by the DOST. Noteworthy to mention is the Comprehensive Technology Transfer and Commercialization program that was initiated in 1990 and aimed at disseminating and commercializing locally developed technologies. Similarly, the Technology Innovation for Commercialization (TECHNICOM) project has a three-pronged target towards: stimulating technological innovation; encouraging private sector adoption and commercialization of innovated technologies; and maximizing returns from government investments in technology innovation activities. The project provides funding assistance to facilitate the transfer and commercialization of research results, particularly coming out from the members of the National Research and Development Network (NRDN) (DOST, 2009).

Building S&T manpower was the goal of the Engineering and Science Education Project implemented under a program loan from the World Bank. Though terminated in 1999, this project was replaced by the so-called Virtual Center for Technology Innovation (Patalinghug, 2003). Under this, the Advanced Science and Technology Institute of the DOST has embarked on a project dubbed Comprehensive Program to Enhance Technology Enterprises (COMPETE) with a goal towards stimulating collaborative R&D among government research institutes, the academe and the private sector (DOST, 2009). Quite a number of programs and projects are still on-going all aimed at developing S&T in the country, in general and to promote technology generation, utilization and commercialization, in particular.

Despite all these efforts however, the Philippine innovation system is still plagued by quite the same problems encountered in 1986 when the STMP was formulated. A review done in-house in 2007 revealed that there was still weak public-private collaboration in R&D; insufficient technology transfer system; limits to technology ownership and information sharing; inadequate support to S&T; weak intellectual property culture; declining R&D human capital; and policy setbacks (PCARRD, 2009). The continuing weak joint effort between the public and private sectors is still attributed to the mismatch between publicly funded technology-generating activities and industry needs.

Perhaps the major reasons for the continued problems of the S&T system is the fact that R&D expenditures remain marginal at the decreasing rates of 0.22 percent of the GDP in 1992, to 0.19 in 1996, 0.15 in 2002, and 0.12 in 2005. Comparing this against the UNESCO standard for developing countries at 1 percent of the GDP makes the situation more serious and lamentable. Yet, this is the problem plaguing other technologically backward economies, how to prioritize limited resources. In addition, S&T manpower in the country remains low, particularly that of scientists. While the ideal prescription of UNESCO is 380 R&D personnel per million population for developing countries, there were 239 R&D personnel per million population in 1992 in the Philippines, which declined to 220 per million population in 1996, and further sliding into 116 personnel per million population in 2002. The figure has slightly increased in 2005 to 127 but remain far from what is critically needed (DOST, 2004).

With this situation of the national innovation system, it is a wonder where firms in the country get the necessary information and knowledge to come up with innovative ideas. Intuitively, one could point to the firms' own internal efforts, which are supposed to develop their own capacities if they are intent on becoming competitive and productive. Their participation in buyer and seller relationships, indeed, production linkages and networks enable them to access information and become aware of emerging technologies. Local suppliers and affiliates/subsidiaries of MNCs are able to derive technology along with FDIs and periodically by new information generated through R&D efforts of their parent companies. Technology is likewise diffused from backward and forward linkages, with the former referring to sources of raw materials, intermediate inputs and equipment, while the latter to buyers of outputs. Customers were often cited as an importance source of information that spurs the firms to innovate to respond to their specifications. New information and technology are also derived from knowledge providers like public R&D institutions, universities and non-profit research organizations. As earlier cited, the government has several technology diffusion and commercialization programs, while there are occurrences of university-industry linkages albeit limited and typically confined to apprenticeship arrangements and contract research.

To provide a more practical scenario of what, indeed, is the situation among firms in the Philippines, a case study of one of the more progressive regions in the country, CALABARZON was undertaken. This would involve looking at the profile of each of the five provinces encompassed by the region and analyzing the dynamics that can be found in relation to production and knowledge linkages, if any. The analysis would also make use of the results of the survey of establishments in CALABARZON done in late 2008.

3. CASE STUDY OF CALABARZON

Figure 1. The CALABARZON Region

CALABARZON stands for Cavite, Laguna, Batangas, Rizal and Quezon. These are the five provinces that comprise the CALABARZON region or Region IV-A, one of the 17 regions of the Philippines. The region lies in South Western Luzon, just south west of the National Capital Region. The table below shows the estimated distance of each province from Metro Manila. Of the five provinces, Rizal is the closest with just some 20 kilometers east of Metro Manila.

Table 2. Proximity to Metro Manila

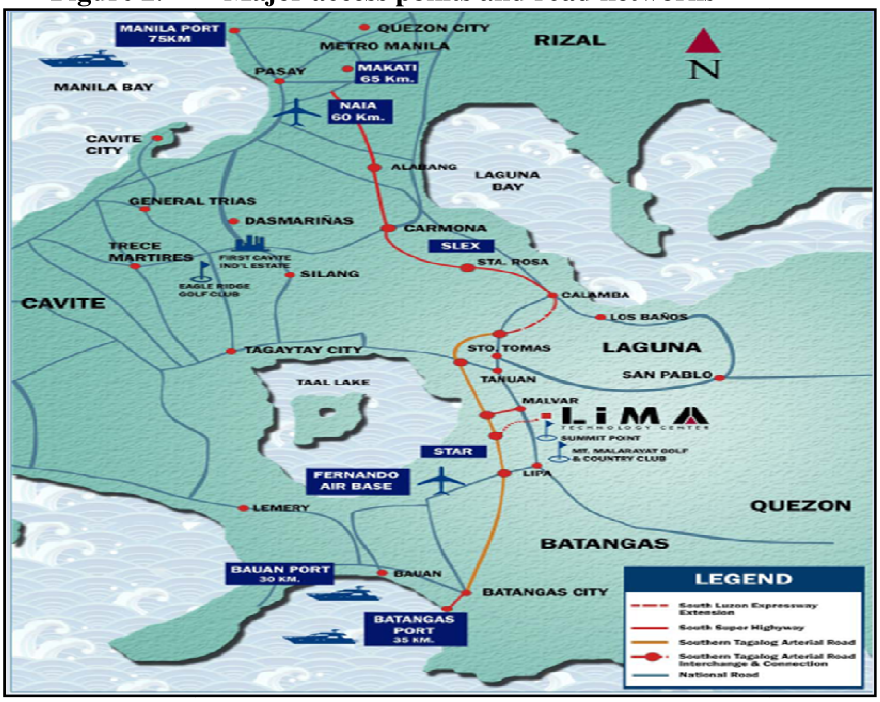
Province	Distance	Location
Cavite	30 kilometers	south of Manila
Laguna	30 kilometers	southeast of Manila
Batangas	110 kilometers	south of Manila
Rizal	20 kilometers	east of Manila
Quezon	89 kilometers	south of Manila

The region is politically subdivided into 12 cities, 130 municipalities and 4,011 barangays. In October 2003, Calamba City, one of the cities in Laguna, was chosen as the regional capital by virtue of Executive Order No. 246.

As of the latest 2007 Census of Philippine population, the region is home to some 11.74 million people. Cavite has the largest population among the CALABARZON provinces with 2.86 million, followed by Rizal with 2.84 million[4]. But in terms of land area, Quezon province proves to be the biggest with 9,069 square kilometres. In total, the region has a total land area of 16,289 square kilometres16and an estimated population density of 600 persons per kilometre.

The term 'growth corridor' aptly describes CALABARZON given its natural boundaries, existing ports and the major road networks that line the region. CALABARZON is connected to Metro Manila via the South Luzon Expressway (SLEX) and the Southern Tagalog Access Road or STAR. The SLEX which runs from the Paco district of Manila, crosses the provinces of Cavite and Laguna through the municipalities of Carmona, San Pedro, Biñan, Sta. Rosa, Cabuyao and Calamba. It reaches Batangas Province via the SLEX extension road adjoining the cities of Calamba and Santo Tomas. The newly completed STAR II then connects Santo Tomas to nearly all of Batangas, including Batangas City where the Batangas International Container Port is located. Quezon and the rest of southern Luzon are accessible through Maharlika High Way coming off from Calamba exit.

Figure 2. Major access points and road networks



CALABARZON is also one of the fastest growing regions in the Philippines. It contributes to 13 percent to the national domestic output (second only to Metro Manila), and has the largest concentration of manufacturing or industrial activities. Of the 117,624 manufacturing establishments in the country in 2007, 15 percent or 17,593 are located in CALABARZON. Likewise, 15 percent of the total number of establishments, estimated to be about 783,870 in 2007, is based in CALABARZON.[5] The economic supremacy of the region is also evident in the bulk of investments and volume of exports produced in the region. As early as 1998 for instance, total investments in CALABARZON amounted to P118 billion, most of which came to the provinces of Batangas and Laguna accounting 44 percent and 36 percent, respectively of the total share.[6] That a substantial amount of investments in the country are channeled through economic zones or industrial parks is also noted. In 2004, 'the government reported a P21.62 billion (or 22.5%) export increase from economic zones, covering the period from January to August of that year. Top performers include Laguna Technopark Inc., with $5.38 billion; followed by Gateway Business Park, $2.99 billion; Amkor Technology Special Ecozone, $1.53 billion; and Lima Technology Center, $520.28 million. Except for Amkor Technology Special Ecozone, all are from the CALABARZON area.'[7]

The above observation only affirms the obvious preference for CALABARZON as the best location for economic zones or industrial parks. It must be noted that of the 179 PEZA registered economic zones in the country, 44 can be found in the CALABARZON provinces with Laguna hosting 17 of these economic zones. Most of these were created through joint ventures between local and foreign partners.

Table 3. PEZA Registered Economic Zones in CALABARZON

Province	Number	Nature/orientation
Cavite	13	High tech; electronics/semi-conductor eqpt manufacturers; ship building
Laguna	17	High tech; electronics/semi-conductor eqpt manufacturers; auto assembly plants; food processing/manufacturing
Batangas	12	agro-industrial processing; shipbuilding; eco-tourism
Rizal	2	agro-industrial processing;eco-tourism
Quezon	0	
CALABARZON	44	

Interestingly, each of the five provinces caters to different types of industrial and manufacturing activities. Much of this has to do with the province's geographic location, inherent natural wealth, as well as man-made resources that include soft and hard infrastructures.

The province of Laguna, hosts 17 industrial parks, has a number of well-known motor vehicle manufacturers, food giants and high tech electronics manufacturers like Toyota Motors, Universal Robina, San Miguel Corporation, Amkor, Fujitsu and many others. The province with its wide expanse of resource-rich, arable land and its close proximity to Metro Manila and other resource-rich provinces have been very effective in luring quality investments for manufacturing activities.

In a similar manner, Cavite which is just within commuting distance to the National Capital Region, finds electronics, automotive parts manufacturing as well as ship building activities good investment priorities due to the presence of such firms across the 13 economic zones located in the province. Although resource-wise Cavite may not be as rich as Laguna, the province is fast catching up, taking advantage of the recent boom in residential/housing projects to spur economic and industrial development in the area.

Batangas on the other hand, due to the accessibility provided by the Batangas International Port, and its close proximity to the agricultural provinces of Quezon, Mindoro and Palawan is excellent for ship-building business activities and agro-industrial processing zones. Moreover, the completion of the Southern Tagalog Access Road II (STAR II) –the four-lane 42 km expressway that runs from Santo Tomas, Batangas to Batangas City, and passes through 6 other Batangas municipalities is expected to enhance intra-regional and intra-provincial connectivity and accelerate economic opportunities in the process.

Rizal's accessibility and closeness to Metro Manila makes it the next best alternative site for manufacturing and agro-industrial activities. Moreover, its growing urban population size may be seen as a favorable market condition by investors.

The province of Quezon is still largely agricultural and the country's leading producer of coconut products like coconut oil and copra. At the moment, there are no economic or industrial zone operating in the area for manufacturing, but the 1995

Special Economic Act has already identified some areas in the province as potential special economic zones that may be dedicated to ecotourism and agribusiness.

To sustain the region's development path and to maximize its growth potential, production facilities, logistics and infrastructure system are continuously being upgraded and developed.[8]

Aside from existing power facilities, several other power projects are underway. These include the 700 megawatt Pagbilao Coal-Fired Thermal Power Plant, Makban Modular Geothermal Power Plant, the Batangas Coal-Fired Power plant, among others. Water is mostly supplied by local water districts but there are also some areas that are serviced by franchise operators of Manila Waterworks and Sewerage System. Industrial zones have their respective water supply system.

In addition to the nearby Ninoy Aquino International Airport and the port of Manila, the region has well functioning ports in Batangas and Quezon. And with the conversion of the Batangas Seaport into an international container and passenger port, the region is expected not only to double its carrying inbound and outbound cargo capacities but also to ease or share in the load traffic in the Port of Manila.

In terms of transport and road network, major artilleries are being improved like the South Luzon Expressway, the Infanta-Maharlika Highway and the Maharlika Highway linking CALABARZON with the Bicol region. The planned expansion of the LRT Line 1 would decongest and improve mobility in the Cavite area.

With respect to telecommunication facilities, CALABARZON is at par with Metro Manila. The improvements undertaken by PLDT enabled direct dialling in the area and made telecommunications less costly. Cellular or mobile telephone carriers, broadband and internet providers are all powered by fiber optic cable network infrastructure. Courier services also abound in the area.

In terms of manpower support, the region gets its supply of competent, skilled and highly trainable workers from the graduates of a number of prestigious learning institutions located therein, foremost of which is the University of the Philippines in Los Banos, Laguna. Also in the region is the APEC Center for Technology Exchange and Training for Small and Medium Enterprises (ACTETSME) in Los Banos—a joint venture of APEC member countries that promotes and offers trainings to small and medium enterprises. Manpower training and skills upgrading programs are also available with the Dual Training Center in Canlubang, which offers hands-on factory training in addition to school work, in close coordination with the Laguna Employment and Manpower Development Center (LEMDC). The Batangas State University has voc-tech programs aimed at improving the students' employability in nearby ecozone firms.

It is also noteworthy that local governments in the region have stepped up to the challenge by setting up policies that would ensure the sustainability of these investments. Some of these are briefly described as follows:

1. Aside from organizing the Cavite Tripartite Industrial Council (CTIC) and the Cavite Industrial Peace Advisory Group (CIPAG), the province of Cavite also has incentives programs for potential and existing locators in Cavite Industrial Parks. The Provincial Development Plan (2005-2010) also saw fit to allocate vast tracks of lands specifically for industrial/economic estates development.
2. The provincial government of Laguna established in 1999 the Laguna Investment Promotions Bureau (LIPB), a one-stop shop designed to guide and assist interested investors regarding the province's business application procedures. This collaborative undertaking by the DTI Provincial Office, Laguna Chamber of Commerce and Industry, the German Confederation of Small Business and Skilled Crafts (ZDH) and Ayala Land, Inc., is a rich source of information as regards the province's economic and industrial standing, geographical make-up and national and local statutes.

   The province is also deeply committed to propagating the 'Culture of Excellence' in the province through creation of the Laguna Area and Productivity Council (LAPC). The Council, with help from the LEMDC, seeks to improve labor productivity in the business and government sectors, the academe, cooperatives, and sectoral associations. This is done by providing training and skills upgrading to the employed, out-of-school youths and retrenched workers.
3. Rizal province is also bullish about opening its doors to wider economic opportunities. This is shown in the 12-point agenda of the province which identifies tourism as the province's centerpiece development program. Integrated infrastructure development as well as openness to trade feature highly in their goals for the coming years.

4. Infrastructure development is Quezon's top priority. The line up of infrastructure projects includes, the completion of Infanta-Marikina road, the establishment of International Container Port in Gen. Nakar, and the construction of the Quezon Provincial Trade and Investment Center, Quezon Science Center, SLSU Quezon Medical School, rehabilitation and improvement of the 15 district hospitals, and construction of 330 schoolrooms.

   The recently approved Provincial Investment and Incentives Code, the various sectoral summits held—all were geared towards attaining the province's key areas for development: agriculture, tourism and economic enterprise. The provincial government is also actively participating in the activities of the Quezon-Lucena Chamber of Commerce Inc., and the "One Town–One Product" (OTOP) Trade Exhibits of the Department of Trade and Industry.

Thus, clearly, as an investment center, CALABARZON presents an attractive alternative to Metro Manila. It must be noted however that the level of development currently being enjoyed by the region has been attained not without some help from the national government, the business sector, foreign funding agencies and a host of other institutional actors. Foremost of which is the CALABARZON Project initiated during the Aquino administration that laid the groundwork and ensured the dispersal of economic growth and industrial progress from Manila to the peripheral area of CALABARZON.[9]

The proliferation of universities, public research institutions, manufacturing firms, industry associations, and seemingly involved local governments create the environment for knowledge linkages conducive to innovation. If such potential is being realized can be determined from the results of the survey of establishments in CALABARZON.

4. RESULTS OF THE 2008 SURVEY ON PRODUCTION AND LOGISTIC NETWORKS IN CALABARZON

The survey for this study was commissioned by the Philippine Institute for Development Studies to the National Statistics Office and was conducted in the last quarter of 2008. Dubbed the 2008 Survey on Production and Logistic Networks of Philippine Manufacturing Industries (SPLN), it collected information on operations of firms in CALABARZON in order to derive understanding on the production linkages and networking between establishments within and outside the clusters and their effects on innovation predisposition of said firms. The survey covered 205 manufacturing establishments with average total employment of 20 and over located in the five provinces of the region. For the SPLN, a systematic sample design was utilized. Of the total firms surveyed, the largest proportion (30 percent) is located in Cavite, followed by those located in Rizal (29 percent). Firms in Batangas comprise one-fifth of the sample while those in Laguna make up 15.6 percent. Firms in Quezon comprise only 5.4 percent of the sample.

Table 4. Surveyed firms by province

Province	Freq.	Percent
Batangas	40	19.5
Cavite	62	30.2
Laguna	32	15.6
Quezon	11	5.4
Rizal	60	29.3
Total	205	100.0

4.1. Year and Place First Started Operation

Firms started operating in the Philippines as early as 1931 and their number rose gradually in the 1960s to the mid 1980s. The number of firms that operated in the country rose more markedly from the late 1980s reaching a peak in the mid 1990s. The number of firms locating their operations in the country declined since the late 1990s.

Table 5. Surveyed firms, by year first started operation in RP

	Freq.	Percent
1930s	1	0.5
1950s	2	1.0
1960s	7	3.4
1970s	9	4.4
1980s	31	15.1
1990s	114	55.6
2000s	41	20.0
Total	205	100.0

A similar trend can be observed in terms of the years when firms located in CALABARZON.

Of all the firms surveyed, 34 percent is located in industrial parks (PEZA[10] areas) while 66 percent is located outside of industrial parks (non-PEZA) areas. All surveyed firms in Rizal and Quezon are located in non-PEZA areas. Majority of firms surveyed in Batangas (65 percent) are also outside PEZA areas. Only in Laguna and Cavite are the majority of firms, 63 percent and 56 percent respectively, located in PEZA areas.

Table 6. Surveyed firms in PEZA and Non-PEZA areas, by province

	Non-PEZA		PEZA		Total	
	Freq	%	Freq	%	Freq	%
Batangas	26	19.1	14	20.3	40	19.5
Cavite	27	19.9	35	50.7	62	30.2
Laguna	12	8.8	20	29.0	32	15.6
Quezon	11	8.1	-	-	11	5.4
Rizal	60	44.1	-	-	60	29.3
Total	136	100.0	69	100.0	205	100.0

4.2. Main Business Activity

The largest proportion of firms (21 percent) produces textiles, apparel, and leather. This is followed by firms whose main products are food, beverages, and tobacco, making up 17 percent of the surveyed firms. Firms producing electronics other than computers comprise close to 15 percent while those manufacturing chemicals, chemical and plastic products, and rubber constitute close to 11 percent. Firms manufacturing metal products constitute almost 8 percent of the firms. Together, the foregoing firms comprise over 70 percent of the firms surveyed.

In Batangas, firms producing food, beverages, and tobacco and textiles, apparel, and leather comprise the largest group, together making up 45 percent of the surveyed firms in the area. In Cavite, firms manufacturing electronics make up the largest group, over one-fourth of the surveyed firms; this is followed by firms producing textiles, apparel, and leather. In Laguna, one-fourth of firms produce food, beverage, and tobacco; the second largest group (comprising about 22 percent) produce electronics. In Quezon, most of the firms (82 percent) produce food, beverages, and tobacco. In Rizal, the largest group of firms (28 percent) manufacture textiles, apparel, and leather; firms producing chemicals, plastic and rubber, and metal products together make up 23 percent.

Table 7. Surveyed firms by main business activity and by province

	Batangas		Cavite		Laguna		Quezon		Rizal		Total	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Food, beverages, tobacco	9	22.5	4	6.5	8	25.0	9	81.8	5	8.3	35	17.1
Textiles, apparel, leather	9	22.5	14	22.6	2	6.3	1	9.1	17	28.3	43	21.0
Wood, wood products	-	-	1	1.6	1	3.1	1	9.1	4	6.7	7	3.4
Paper, paper products, printing	-	-	1	1.6	1	3.1	-	-	3	5.0	5	2.4
Chemicals, chemical & plastic products, rubber	5	12.5	6	9.7	4	12.5	-	-	7	11.7	22	10.7
Other non-metallic minerals	1	2.5	4	6.5	-	-	-	-	3	5.0	8	3.9
Iron, steel	-	-	3	4.8	-	-	-	-	2	3.3	5	2.4
Non-ferrous metals	-	-	-	-	1	3.1	-	-	-	-	1	0.5
Metal products	5	12.5	2	3.2	2	6.3	-	-	7	11.7	16	7.8
Machinery, equipment, tools	1	2.5	3	4.8	1	3.1	-	-	3	5.0	8	3.9
Computers, computer parts	-	-	-	-	1	3.1	-	-	-	-	1	0.5
Other electronics, electronic components	6	15.0	16	25.8	7	21.9	-	-	1	1.7	30	14.6
Precision instruments	-	-	1	1.6	-	-	-	-	-	-	1	0.5
Automobile, auto parts	3	7.5	3	4.8	3	9.4	-	-	3	5.0	12	5.9
Other transportation equipment	-	-	1	1.6	-	-	-	-	-	-	1	0.5
Others	1	2.5	3	4.8	-	-	-	-	5	8.3	9	4.4
No response	-	-	-	-	1	3.1	-	-	-	-	1	0.5
Total	40	100.0	62	100.0	32	100.0	11	100.0	60	100.0	205	100.0

4.3. Capital Structure

Majority of the firms surveyed (51 percent) are 100 percent locally-owned. Almost three out of ten are foreign-owned while about 20 percent characterized ownership as joint ventures.

Table 8. Surveyed firms by capital structure

	Freq.	Percent
100% Locally-owned	104	50.7
100% Foreign-owned	59	28.8
Joint Venture	42	20.5
Total	205	100.0

Among the non-Filipino investors, the Japanese make up the largest group comprising almost 20 percent of the non-Filipino investors. These are followed by the South Koreans (10 percent) and Taiwanese (8 percent). American investors make up only 4 percent of all non-Filipino investors while European investors make up only 2.4 percent. Other foreign investors each make up less than 2 percent of non-Filipino investors.

Table 9. Nationality of Non-Filipino investors

	Freq.	Percent
Singaporean	3	1.5
Other ASEAN	2	1.0
Chinese	3	1.5
Japanese	40	19.5
South Korean	20	9.8
Taiwanese	16	7.8
Other Asian	2	1.0
American	8	3.9
European	5	2.4
Others (Canadian, Indian)	2	1.0
Total	101	100.0

4.4. Size of operation

Large enterprises with employees of 200 or more make up the most number of firms, comprising 42 percent; half of these have 500 or more employees. These are followed by small enterprises with employees of 10 to 99, constituting at least 34 percent of all surveyed firms. Medium enterprises with employees of 100 to 199 comprise 16 percent of the firms. Micro-enterprises make up at most 8 percent of the firms.

Table 10. Surveyed firms by number of fulltime employees, as of date of visit

	Freq.	Percent
1-19	17	8.3
20-49	36	17.6
50-99	34	16.6
100-199	32	15.6
200-299	21	10.2
300-399	11	5.4
400-499	9	4.4
500-999	31	15.1
1,000-1,499	7	3.4
1,500-1,999	4	2.0
2,000 & above	3	1.5
Total	205	100.0

In terms of assets, 82 percent of the firms have assets of 100 thousand dollars and over. Almost 60 percent have assets of at least 500 thousand dollars while over 50 percent have assets of one million dollars and over. Almost three out of ten have assets of five million dollars and above while over one fifth have assets of at least ten million dollars. Only 18 percent have assets less than 100 thousand dollars. The assets of the firms as of the survey period are very much similar to their assets for 2007.

Table 11. Average assets of firms

	Freq	Percent
less than 10,000	7	3.4
10,000-24,999	8	3.9
25,000-49,999	9	4.4
50,000-74,999	6	2.9
75,000-99,999	6	2.9
100,000-499,999	47	22.9
500,000-999,999	17	8.3
1 million-4.9 million	45	22.0
5 million-9.9 million	15	7.3
10 million and above	44	21.5
NA/NR	1	0.5
Total	205	100.0

4.5. Target Markets and Origins of Raw Materials and Supplies

For most of the firms (57 percent), the most important market is the Philippines. For close to 27 percent of firms, NCR is the most important market while for 25 percent, CALABARZON is the most important market. Next to CALABARZON, the most important market for almost 20 percent of firms is the U.S. followed by Japan at 13 percent. Only about 5 percent of firms have Europe as the most important market. Thailand, Malaysia, China, South Korea, Taiwan and others each are the most important markets to less than 2 percent of firms. (Table 12)

For almost half of the firms, raw materials come primarily from within the country. For about 24 percent, these come from NCR while for 17 percent, they come from within CALABARZON. Next to the Philippines, Japan is the most important source of raw materials where 16 percent of firms rely on it, followed by China (11 percent), South Korea (6 percent) and Taiwan (5 percent). Other countries/regions including the U.S. and Europe each are the most important source of raw materials for less than 3 percent of firms. (Table 13)

Table 12. Surveyed firms' 1st most important target markets

	Freq.	Percent
RP (NCR)	56	27.3
RP (CALABARZON)	52	25.4
RP (other regions)	8	3.9
THAILAND (greater BKK)	1	0.5
MALAYSIA	1	0.5
CHINA	1	0.5
JAPAN	27	13.2
S.KOREA	3	1.5
TAIWAN	3	1.5
U.S.	39	19.0
EUROPE	10	4.9
OTHERS	4	2.0
Total	205	100.0

Table 13. Surveyed firms' 1st most important source of raw materials

	Freq.	Percent
INDONESIA (other regions)	1	0.5
RP (NCR)	50	24.4
RP (CALABARZON)	34	16.6
RP (other regions)	16	7.8
SINGAPORE	3	1.5
MALAYSIA	2	1.0
Other ASEAN	2	1.0
CHINA	22	10.7
JAPAN	33	16.1
S.KOREA	13	6.3
TAIWAN	10	4.9
OTHER ASIA	2	1.0
U.S.	6	2.9
EUROPE	6	2.9
OTHERS	5	2.4
Total	205	100.0

As for the second most important source of raw materials, CALABARZON is the topmost answer for 14 percent of firms, followed by NCR and China (11 percent each) and other regions in the Philippines (7 percent). Taiwan is the second most important source for 6 percent of firms while it is the U.S. and Japan for 5 percent each.

Table 14. Surveyed firms' 2nd most important source of raw materials

	Freq.	Percent
INDONESIA (greater Jakarta)	2	1.0
INDONESIA (other regns)	1	0.5
RP (NCR)	22	10.7
RP (CALABARZON)	29	14.2
RP (other regns)	14	6.8
THAILAND (greater BKK)	3	1.5
THAILAND (other regions)	1	0.5
VIETNAM (greater Hanoi)	1	0.5
SINGAPORE	7	3.4
MALAYSIA	8	3.9
CHINA	22	10.7
JAPAN	11	5.4
S.KOREA	6	2.9
TAIWAN	13	6.3
OTHER ASIA	8	3.9
U.S.	11	5.4
EUROPE	6	2.9
NA/NR	40	19.5
Total	205	100.0

4.6. Major Functions of Firms

The survey asked the firms for the three major functions of their establishments. A total of 159 firms indicated that they carry out production of final products while 103 mentioned that they undertake procurement of raw materials, parts or supplies. Seventy-six firms are engaged in processing of raw materials as there are 60 that mentioned they are into production of components and parts. There are 39 firms that are engaged in marketing and sales promotion.

Table 15. Major functions carried out by surveyed firms in 2008

	Freq	Percent
Production (raw matls processing)	76	16.7
Production (components & parts)	60	13.2
Production (final products)	159	34.9
Procurement of raw matls, parts, or supplies	103	22.6
IT systems devt, maintenance	6	1.3
After sales services	10	2.2
Marketing, sales promotion	39	8.6
Others	2	0.4
Total	455	100.0

4.7. Research and Development

Research and development activities are carried out by 24 percent of the firms surveyed. Among non-PEZA firms, 28 percent carried out R&D while only 17 percent of PEZA firms did. Majority (51 percent) of the food producers undertake R&D while almost one third (32 percent) of chemical producers claimed that they also do. Among producers of machineries, equipment and tools; metal products; and other non-metallic mineral products, nearly 20 percent carry out R&D.

Table 16. Surveyed firms that carry out R&D activities

	Yes		No		Total	
	Freq	Percent	Freq	Percent	Freq	Percent
Non-PEZA	38	76.0	98	63.2	136	66.3
PEZA	12	24.0	57	36.8	69	33.7
Total	50	100.0	155	100.0	205	100.0

Table 17. Surveyed firms that carry out R&D activities, by main business activity

	Yes		No		Total	
	Freq	Percent	Freq	Percent	Freq	Percent
Food,beverages,tobacc	18	36.0	17	11.0	35	17.1
Textiles,apparel,leat	7	14.0	36	23.2	43	21.0
Wood,wood products	0	-	7	4.5	7	3.4
Paper,paper products,	1	2.0	4	2.6	5	2.4
Chemicals,chemical &	7	14.0	15	9.7	22	10.7
Other non-metallic mi	2	4.0	6	3.9	8	3.9
Iron,steel	0	-	5	3.2	5	2.4
Non-ferrous metals	0	-	1	0.6	1	0.5
Metal products	4	8.0	12	7.7	16	7.8
Machinery,eqpt,tools	2	4.0	6	3.9	8	3.9
Computers,computer pa	0	-	1	0.6	1	0.5
Other electronics,ele	5	10.0	25	16.1	30	14.6
Precision instruments	0	-	1	0.6	1	0.5
Automobile,auto parts	0	-	12	7.7	12	5.9
Other transportatn eq	0	-	1	0.6	1	0.5
Others	4	8.0	5	3.2	9	4.4
NA/NR	0	-	1	0.6	1	0.5
Total	50	100.0	155	100.0	205	100.0

Among those who undertake research; 66 percent carry out both basic and applied research. About a quarter undertake only basic research while10 percent carry out only applied research.

Table 18. Firms with R&D activities in CALABARZON, by type of activities

	Freq.	Percent
Basic research	12	24.0
Applied research	5	10.0
Both basic&applied research	33	66.0
Total	50	100.0

This refers to firms with R&D departments. Among them, 55 percent have 1-5 employees engaged in R&D related work, while 22 percent have 6-10 employees dedicated to R&D. For 12 percent of firms, 11-15 employees are engaged in R&D and for 5 percent of these firms, 21-25 employees do R&D. Only 5 percent of the firms employ 26-50 people in R&D.

Table 19. Average number of R&D employees

	Freq.	Percent
1-5 employees	22	55
6-10 employees	9	22.5
11-15 employees	5	12.5
21-25 employees	2	5
26-50 employees	2	5
Total	40	100

**refers to firms with R&D departments; only 40 of the 50 firms doing R&D activities have R&D departments*

Of the 50 firms doing R&D, over half (52%) of them spend only up to 0.5 percent of the value of their sales on R&D. Meanwhile, 14 percent spend 1 to 1.5 percent of their sales value on R&D; 12 percent spend 0.5 to 1 percent; 6 percent allocate 1.5 to 2 percent the value of their sales on R&D while 2 percent spend 2 to 2.5 percent. Still, there are firms that allocate 4-5 percent and over 5 percent, as indicated by 2 and 3 firms, respectively.

Table 20. R&D Expenditure (as % of Total Sales)

	Freq.	Percent
No expenditure	1	2
0.01 - 0.50%	26	52
0.51 - 1.0%	6	12
1.01 - 1.5%	7	14
1.51 - 2.0%	3	6
2.01 - 2.5%	1	2
4.01 - 5.0%	2	4
5.01% - above	3	6
NA/NR	1	2
Total	50	100

4.8. Innovative Activities for Business Upgrading

Majority (51 percent) of the firms introduced new products in the past three years. Of these firms, 81 percent of them introduced these in existing markets while only 19 percent launched these in new markets. Meanwhile, 71 percent of the firms with new products based these on existing technologies while 29 percent produced these using new technologies. The share of new products to total sales increased compared to the last three years for about two-thirds of the firms with new products.

Table 21. Innovative activities: Product Innovation

	Total		Large Firms		SME Firms	
	Freq	% Share	Freq	% Share	Freq	% Share
Introduced new products to the market in the recent 3 years	105	100.00	54	100.00	51	100.00
Existing market	85	80.95	46	85.19	39	76.47
New market	20	19.05	8	14.81	12	23.53
Existing technology	75	71.43	43	79.63	32	62.75
New technology	30	28.57	11	20.37	19	37.25
Intro.of new products increased total sales	69	65.71	38	70.37	31	60.78

Among the surveyed firms, 58 percent bought new machines or facilities with new functions to their operations while 73 percent improved existing machines, equipment, or facilities. There were 66 percent of firms that introduced new know-how on production methods. A significant proportion of establishments made efforts to improve business processes or organizations in the past three years. About 3 in 10 introduced ICT to reorganize its business processes while over 6 out of 10 introduced other internal activities to respond to changes in the market. Moreover, almost half adopted an international standard (e.g. ISO). (Table 22)

In terms of market-based innovation, 43 percent of the firms secured a new local supplier in CALABARZON in the past three years while 49 percent secured a new local supplier in the Philippines outside CALABARZON. Only 10 percent secured a new MNC or joint venture (JV) supplier in CALABARZON while a little more (16 percent) secured a new MNC or JV supplier in the Philippines outside CALABARZON.

Table 22. Innovative Activities: Process Innovation

	Total			
	Yes		No	
	Freq	% Share	Freq	% Share
Q10				
Bought new machines	118	57.6	87	42.4
Improved existing machine	148	72.2	57	27.8
Intro new know-how	134	65.4	71	34.6
Q13				
Adopted an ISO	99	48.3	106	51.7
Intro ICT	59	28.8	146	71.2
Intro other internal activities	125	61.0	80	39.0

About 31 percent of firms secured a new supplier in other ASEAN countries; 36 percent secured a new supplier in China, Japan, Korea, Taiwan; and less than 30 percent secured a new supplier in other foreign countries.

Table 23. Innovative Activities: Market-based Innovation

	Total			
	Yes		No	
	Freq	% Share	Freq	% Share
Q11				
Secured new local supplier in CALABARZON	88	42.9	117	57.1
Secured new local supplier in RP	100	48.8	105	51.2
Secured a new MNC supplier in CALABARZON	21	10.2	184	89.8
Secured a new MNC supplier outside CALABARZON	32	15.6	173	84.4
Secured a new supplier in other ASEAN Countries	63	30.7	142	69.3
Secured a new supplier in other countries in East Asia	73	35.6	132	64.4
Secured a new supplier in other foreign countries	59	28.8	146	71.2
Q12				
Secured new local customer in CALABARZON	69	33.7	136	66.3
Secured new local customer in RP	81	39.5	124	60.5
Secured a new MNC customer in CALABARZON	25	12.2	180	87.8
Secured a new MNC customer outside CALABARZON	32	15.6	173	84.4
Secured a new customer in other ASEAN Countries	46	22.4	159	77.6
Secured a new customer in other countries in East Asia	50	24.4	155	75.6
Secured a new customer in other foreign countries	66	32.2	139	67.8

When it comes to new customers, almost 40 percent of firms secured a new local customer in the Philippines while nearly 34 percent engaged a new local customer in CALABARZON. New customers were likewise secured outside of the country by 79 percent of firms. Of these, 22 percent were from other ASEAN countries, while 24 percent were new customers in East Asian countries. It is noted that about 16 percent secured a new MNC or JV customer in the Philippines and 12 percent secured a new MNC or JV customer in CALABARZON.

Looking at the survey results on the angle of size of the firms, it was found that there are slightly more large firms that introduced new products than small firms or SMEs but the pattern as to where the products were introduced and how follows the pattern for all firms.

Table 24. Innovative activities, by size of firms

	Total		Large Firms		SME Firms	
	Freq	% Share	Freq	% Share	Freq	% Share
Introduced new products to the market in the recent 3 years	105	100.00	54	100.00	51	100.00
Existing market	85	80.95	46	85.19	39	76.47
New market	20	19.05	8	14.81	12	23.53
Existing technology	75	71.43	43	79.63	32	62.75
New technology	30	28.57	11	20.37	19	37.25
Intro.of new products increased total sales	69	65.71	38	70.37	31	60.78

When it comes to process innovation, the trend between large firms and SMEs is not much different with more of the latter resorting to improving existing machineries and introducing know-how than the former. In contrast, the adoption of ISO or other international standards and integration of ICT applications to their operations were found more on large firms than SMEs.

Table 25. Process Innovation, by size of firms

	Total		Large Firms		SME Firms	
	Freq	% Share	Freq	% Share	Freq	% Share
Q10						
Bought new machines	118	57.6	59	50.0	59	50.0
Improved existing machine	148	72.2	69	46.6	79	53.4
Intro new know-how	134	65.4	66	49.3	68	50.7
Q13						
Adopted an ISO	99	48.3	54	54.5	45	45.5
Introduction of ICT	59	28.8	35	59.3	24	40.7
Introduction of other internal activities	125	61.0	61	48.8	64	51.2

In terms of market innovation, SMEs were found to be more domestically oriented in terms of sourcing out suppliers, though there were more of them which were able to secure MNC suppliers outside of the region. Large firms are more outward oriented with more of them securing suppliers from outside of the country. This orientation by size of firms is all the more pronounced when it comes to getting new customers as evidenced by the results of the survey wherein significantly more SMEs target new customers from within the region and the country, whether said customers are locally owned or MNCs. Large firms meanwhile, are more internationally oriented.

Table 26. Market Innovation, by size of firms

	Total		Large		SMEs	
	Freq	% Share	Freq	% Share	Freq	% Share
Q11						
Secured new local supplier in CALABARZON	88	42.9	44	50.0	44	50.0
Secured new local supplier in RP	100	48.8	43	43.0	57	57.0
Secured a new MNC supplier in CALABARZON	21	10.2	14	66.7	7	33.3
Secured a new MNC supplier outside CALABARZON	32	15.6	15	46.9	17	53.1
Secured a new supplier in other ASEAN Countries	63	30.7	36	57.1	27	42.9
Secured a new supplier in other countries in EA	73	35.6	42	57.5	31	42.5
Secured a new supplier in other foreign countries	59	28.8	33	55.9	26	44.1
Q12						
Secured new local customer in CALABARZON	69	33.7	17	24.6	52	75.4
Secured new local customer in RP	81	39.5	20	24.7	61	75.3
Secured a new MNC customer in CALABARZON	25	12.2	5	20.0	20	80.0
Secured a new MNC customer outside CALABARZON	32	15.6	9	28.1	23	71.9
Secured a new customer in other ASEAN Countries	46	22.4	32	69.6	14	30.4
Secured a new customer in other countries in EA	50	24.4	30	60.0	20	40.0
Secured a new customer in other foreign countries	66	32.2	38	57.6	28	42.4

4.9. Business Linkages with Main Customer and Supplier

For 43 percent of the firms, the main product/raw material sold to their main customers is customized. For 54 percent, the main product is standard. There are 18 firms located in industrial parks whose most important customers are also located in industrial parks. Of these, 6 customers are in the same industrial park, while 12 are in other industrial parks.

Table 27. Is the main product bought from the surveyed firms by its most impt customer customized or standard?

	Freq.	Percent
Customized	88	42.93
Standard	110	53.66
NA/NR	7	3.41
Total	205	100

Table 28. Most important customers located in industrial parks

	Freq.	Percent
in the same Industrial Park	6	33.3
in other Industrial Park	12	66.7
Total	18	100.0

Most (57 percent) of the firms only use truck / car to transport their products to their most important customers indicating easy accessibility. Twenty percent of firms utilize liner shipping while 17 percent use airplane, which denote that the most important customers are located outside of the region or of the country. Meanwhile, very few use other modes of transportation.

Table 29. Main mode of transportation of surveyed firms' most important customer

	Freq.	Percent
Truck/Car only	115	56.1
Airplane	35	17.1
Train	1	0.5
Ship(Cabotage)	7	3.4
Via foreign port	2	1.0
Ship(Liner)	41	20.0
NA/NR	4	2.0
Total	205	100.0

Majority (54 percent) of the firms are within 200 kilometers distance from their most important customers, with 8 percent only 10 kilometers away, 13 percent about 11 to 25 kilometers away, 12 percent are 26-50 kilometers away. For 42 percent of firms, the distance between them and their most important customers is over 1000 kilometers. The results seem to indicate that the majority of the surveyed firms' most important customers are within proximity of the region or within the country, while the significantly remaining percentage refers to those outside of the Philippines.

Table 30. Estimated distance from most important customer

	Freq.	Percent
0-10 kilometers	17	8.29
11-25 kilometers	27	13.17
26-50 kilometers	25	12.20
51-100 kilometers	25	12.20
101-200 kilometers	16	7.80
201-300 kilometers	2	0.98
301-400 kilometers	1	0.49
401-500 kilometers	1	0.49
501-1,000 kilometers	2	0.98
1,001 or more	85	41.46
NR/NA	4	1.95
Grand Total	205	100.00

For 6 out of ten firms, their most important customer implements the just-in-time distribution system. About 3 out of ten are planning to implement it, while in contrast, 5 and 6 percent do not have a plan and do not need the system, respectively. Only 12 percent of the firms have a capital tie-up with their customers. For 62 percent of the firms, their most important customer is a large firm.

Table 31. Firms that adhere to JIT system

	Freq.	Percent
Implemented	120	58.54
Planning	59	28.78
No plan	10	4.88
No ned	12	5.85
NA/NR	4	1.95
Grand Total	205	100.00

Table 32. Surveyed firms with capital tie-up with the customer

	Large Firms		SME Firms		Total	
	Freq	% Share	Freq	% Share	Freq	% Share
With capital tie-up	11	5.37	14	6.83	25	12.20
Without capital tie-up	67	32.68	109	53.17	176	85.85
NA/NR	2	0.98	2	0.98	4	1.95
Grand Total	80	39.02	125	60.98	205	100.00

The largest proportion of firms has 10 years or more established relationship with their most important customers. For 21 percent, the relationship has been for 4 to 6 years while for 18 percent, it is 7 to 9 years. About 10 percent maintains a 1 to 3 year old relationship with their main customers and only 3 percent have a relationship of less than a year with their main customers.

Table 33. Duration of relationship of surveyed firm with its most important customer

	Freq.	Percent
Less than 1 year	6	2.93
1-3 yrs	19	9.27
4-6 yrs	42	20.49
7-9 yrs	36	17.56
10 yrs & more	97	47.32
NA/NR	5	2.44
Total	205	100

Only about 33 percent of the establishments accept engineer(s) dispatched by their most important customers. Further, only 29 percent dispatch engineer(s) to their most important customers. The former finding indicates that there are customers that ensure that technical information are shared to their supplier-firms.

Table 34. Does this establishment accept engineer/s from the customer?

	Freq.	Percent
Yes	67	32.7
No	134	65.4
NA/NR	4	2.0
Total	205	100.0

Table 35. Does this establishment dispatch engineer/s to your customer?

	Freq.	Percent
Yes	60	29.3
No	141	68.8
NA/NR	4	2.0
Total	205	100.0

Most of the firms believe (80%) that their main customer is an important partner for innovation and upgrading. Nearly 12 percent perceive that their main customer is somewhat important while only five percent are not sure or do not think that their customer is a partner for innovative pursuits. These results are an indication that the customers, especially those they consider as most important for varied reasons, are not only vital to the firms' operations but are essential sources of technology and information as well.

Table 36. Importance of this customer as a partner for innovation & upgrading

	Freq.	Percent
Very important	164	80.0
Somewhat important	24	11.7
Not sure	4	2.0
Not very important	4	2.0
Not important at all	2	1.0
NA/NR	7	3.4
Total	205	100.0

4.10. Sources of Information and New Technologies for Innovation and Business Upgrading

Twenty percent of firms are practicing R&D in their own R&D department. Of these, 37 percent consider this as very important, while 17 percent see it as somewhat important. About 25 percent obtain information and new technology from their own sales department or sales agent where 55 percent of them considering this as a very important source and 19 percent consider it somewhat important. There are almost 30 percent of firms that get information and new technology from their own production or manufacturing department and this source is deemed very important by 71 percent of these firms, while 13 percent see it as somewhat important. Only 17 percent obtain information and new technology from a technological agreement with the headquarters or affiliated firm. Of these firms, 45 percent consider this very important while 21 percent consider it somewhat important.

Only 5 percent of firms obtain information and technology from joint ventures established with other local firms. Only 14 percent see this source as very important but some 23 percent deem it somewhat important. Almost 10 percent get information from local supplier or customer and of these 30 percent consider this source important and another 25 percent see it as somewhat important. Only 7 percent of firms obtain information and new technology from their local competitors, as 14 percent see this as a very important source; another 30 percent consider it somewhat important.

Five percent of local firms obtain information and technology from local firms in other businesses. Only 7 percent think this source is very important although 22 percent feel it is somewhat important. There are 8 percent of firms that obtain information and new technology from licensing technologies from other local firms, where 11 percent believe this source is very important; 26 percent think it is somewhat important. Almost

10 percent of firms gather information and new technology from local consultants they hired. Of these, 16 percent consider this source very important and 25 percent think it is somewhat important.

In terms of occurrence of technology transfer from foreign firms, it can be noted that almost 13 percent of surveyed firms are practicing this.

When it comes to technical assistance by local organizations, only 9 percent of firms receive technical assistance financed/provided by government/public agencies, with 20 percent believing that this source is very important and 24 percent considering it is somewhat important. A measly 7 percent of the surveyed firms receive technical assistance financed/provided by local business organizations, while only 5 percent participate in research consortium organized with the support of government. Of these firms, 15 percent think this source of information is important, while 22 percent consider it somewhat important. A similar 5 percent of the firms participate in research consortium organized with the support of local business organization; another 5 percent join business consortium organized with the support of government; and about 7 percent of firms participate in a business consortium organized with the support of local business organization.

It is noteworthy, mainly for the apparent weakness of the relationship, that only 6 percent of firms have technical cooperation with (or assistance from) local university or R&D institute. A marginal percentage of 3 percent have technical cooperation with (or assistance from) foreign university or R&D institute, while 4 percent receive information from academic societies and academic journals.

In terms of other sources of technology, 13 percent of surveyed firms recruit mid-class personnel who may be able to infuse fresh knowledge and technological experience. About 8 percent recruit personnel retired from MNCs and large firms as they could be bringing with them advanced knowledge and technology from their former employers. Meanwhile, technical information obtainable from patents (used by 15 percent) is considered a source of new technologies by 6 percent of the firms, while introduction of "foreign-made" equipment and software are practiced by 9 percent of the firms and reverse engineering by 5 percent.

Table 37. Sources of New Technologies

	100% Foreign-owned		100% Locally-owned		Joint Venture		Grand Total		% Share
	Freq	% Share	Freq	% Share	Freq	% Share	Freq	% Share	Total Firms
Internal sources of info and own R&D efforts	51	100.00	92	100.00	46	100.00	189	100.00	
1. Own R&D	11	21.57	20	21.74	11	23.91	42	22.22	20.5
2. Own sales dept	12	23.53	28	30.43	11	23.91	51	26.98	24.9
3. Own production	15	29.41	33	35.87	13	28.26	61	32.28	29.8
4. Technical agreement w/ Headquarters	13	25.49	11	11.96	11	23.91	35	18.52	17.1
	100% Foreign-owned		100% Locally-owned		Joint Venture		Grand Total		% Share
	Freq	% Share	Freq	% Share	Freq	% Share	Freq	% Share	Total Firms
Technology Transfer from Local firms	20	100.00	36	100.00	36	100.00	92	100.00	
1. Joint Venture with other local firms	3	15.00	2	5.56	6	16.67	11	11.96	5.4
2. Local supplier or customer	3	15.00	10	27.78	7	19.44	20	21.74	9.8
3. Local competitor	3	15.00	8	22.22	3	8.33	14	15.22	6.8
4. Local firms in different business with neither supplier nor customer	3	15.00	4	11.11	3	8.33	10	10.87	4.9
5. Licensing technology from other local firms	3	15.00	5	13.89	9	25.00	17	18.48	8.3
6. Local consultant hired	5	25.00	7	19.44	8	22.22	20	21.74	9.8
Technology Transfer from Firms or Corporation w/ MNCs	34	100.00	21	100.00	42	100.00	97	100.00	
1. Joint Venture with other Foreign firms	6	17.65	3	14.29	8	19.05	17	17.53	8.3
2. Foreign supplier or customer	7	20.59	9	42.86	10	23.81	26	26.80	12.7
3. Foreign competitor	5	14.71	3	14.29	6	14.29	14	14.43	6.8
4. Foreign competitor in the same business (neither supplier or customer)	5	14.71	3	14.29	6	14.29	14	14.43	6.8
5. Licensing technology from other MNCs	5	14.71	2	9.52	5	11.90	12	12.37	5.9
6. International consultant	6	17.65	1	4.76	7	16.67	14	14.43	6.8
	100% Foreign-owned		100% Locally-owned		Joint Venture		Grand Total		% Share
	Freq	% Share	Freq	% Share	Freq	% Share	Freq	% Share	Total Firms
Technical assistance by local organizations	27	100.00	28	100.00	25	100.00	80	100.00	
1. Technical Assistance by government	7	25.93	7	25.00	5	20.00	19	23.75	9.3
2. Technical Assistance by local business organizations	5	18.52	5	17.86	5	20.00	15	18.75	7.3
3. Research consortium w/ government support	3	11.11	3	10.71	5	20.00	11	13.75	5.4
4. Research consortium w/ local business organization support	4	14.81	3	10.71	3	12.00	10	12.50	4.9
5. Business consortium w/ government support	4	14.81	4	14.29	3	12.00	11	13.75	5.4
6. Business consortium w/ local business organization support	4	14.81	6	21.43	4	16.00	14	17.50	6.8
Linkages w/ universities, R&D institutes and academic society	10	100.00	3	100.00	15	100.00	28	100.00	
1. Technical cooperation with local university or R&D institute	3	30.00	2	66.67	8	53.33	13	46.43	6.3
2. Technical cooperation with foreign university or R&D institute	3	30.00		-	3	20.00	6	21.43	2.9
3. Academic Society and academic journal	4	40.00	1	33.33	4	26.67	9	32.14	4.4
	100% Foreign-owned		100% Locally-owned		Joint Venture		Grand Total		% Share
	Freq	% Share	Freq	% Share	Freq	% Share	Freq	% Share	Total Firms
Human Resources	14	100.00	11	100.00	19	100.00	44	100.00	
1. Recruitment of mid-class personnel	9	64.29	5	45.45	13	68.42	27	61.36	13.2
2. Recruitment of personnel retired from MNCs	5	35.71	6	54.55	6	31.58	17	38.64	8.3
Other sources	19	100.00	10	100.00	14	100.00	43	100.00	
1. Technical information obtainable from patents	6	31.58	4	40.00	3	21.43	13	30.23	6.3
2. Introduction of "foreign-made" equipment and software	8	42.11	4	40.00	7	50.00	19	44.19	9.3
3. Reverse engineering	5	26.32	2	20.00	4	28.57	11	25.58	5.4

Of the 189 firms who responded to this question, more SMEs were found to be reliant on their internal sources of information and own R&D capacities than large firms. But this could also be because there are more SMEs covered by the survey. Among the large firms, they are fairly spread out when it comes to specific internal sources with own production standing out compared to own R&D, own sales department and technical agreement with headquarters. Perhaps, the reason for this is that there are not a lot of firms with R&D departments. Of the SMEs, own production departments also top the list.

On technology transfer from local firms, local consultants hired and licensing technology from other firms are the two top sources of large firms. In contrast, SMEs are more attuned to their local customers and suppliers, followed by their awareness of the technologies being used by their local competitors. This is true even for foreign customers and suppliers, which is the top channel of technology for SMEs, where joint venture activities with foreign firms follow. This is an indication that FDIs do lead to technology transfers. The same can be said for large firms which as it turned out, follow the same trend as SMEs. However, they were also found to be still reliant on consultants, this time, foreign based. Meanwhile, technical assistance by local organizations as well as R&D institutes and the universities are not strong. Among the large firms, technical assistance from the government topped the list, though the rest of the firms are fairly spread out in the other types of linkages. They also have more

Table 38. Sources of New Technologies, by size of firms

	LARGE		SME		TOTAL	
	Freq	% Share	Freq	% Share	Freq	% Share
Internal sources of info and own R&D efforts	87	100.00	102	100.00	189	100.00
1. Own R&D	20	22.99	22	21.57	42	22.22
2. Own sales dept	22	25.29	29	28.43	51	26.98
3. Own production	25	28.74	36	35.29	61	32.28
4. Technical agreement w/ Headquarters	20	22.99	15	14.71	35	18.52
	LARGE		SME		TOTAL	
	Freq	% Share	Freq	% Share	Freq	% Share
Technology Transfer from Local firms	41	100.00	51	100.00	92	100.00
1. Joint Venture with other local firms	6	14.63	5	9.80	11	11.96
2. Local supplier or customer	7	17.07	13	25.49	20	21.74
3. Local competitor	4	9.76	10	19.61	14	15.22
4. Local firm in different business with neither supplier nor customer	4	9.76	6	11.76	10	10.87
5. Licensing technology from other local firms	9	21.95	8	15.69	17	18.48
6. Local consultant hired	11	26.83	9	17.65	20	21.74
Technology Transfer from Firms or Cooperation w/ MNCs	56	100.00	41	100.00	97	100.00
1. Joint Venture with other Foreign firms	11	19.64	6	14.63	17	17.53
2. Foreign supplier or customer	13	23.21	13	31.71	26	26.80
3. Foreign competitor	8	14.29	6	14.63	14	14.43
4. Foreign competitor in the same business (neither supplier or customer)	7	12.50	7	17.07	14	14.43
5. Licensing technology from other MNCs	7	12.50	5	12.20	12	12.37
6. International consultant	10	17.86	4	9.76	14	14.43
	LARGE		SME		TOTAL	
	Freq	% Share	Freq	% Share	Freq	% Share
Technical assistance by local organizations	36	100.00	44	100.00	80	100.00
1. Technical Assistance by government	9	25.00	10	22.73	19	23.75
2. Technical Assistance by local business organizations	5	13.89	10		15	18.75
3. Research consortium w/ government support	7	19.44	4	9.09	11	13.75
4. Research consortium w/ local business organization support	5	13.89	5	11.36	10	12.50
5. Business consortium w/ government support	5	13.89	6	13.64	11	13.75
6. Business consortium w/ local business organization support	5	13.89	9	20.45	14	17.50
Linkages w/ universities, R&D institutes and academic society	18	100.00	10	100.00	28	100.00
1. Technical cooperation with local university or R&D institute	8	44.44	5	50.00	13	46.43
2. Technical cooperation with foreign university or R&D institute	4	22.22	2	20.00	6	21.43
3. Academic Society and academic journal	6	33.33	3	30.00	9	32.14
	LARGE		SME		TOTAL	
	Freq	% Share	Freq	% Share	Freq	% Share
Human Resources	19	100.00	25	100.00	44	100.00
1. Recruitment of mid-class personnel	13	68.42	14	56.00	27	61.36
2. Recruitment of personnel retired from MNCs	6	31.58	11	44.00	17	38.64
Other sources	24	100.00	19	100.00	43	100.00
1. Technical information obtainable from patents	7	29.17	6	31.58	13	30.23
2. Introduction of "foreign-made" equipment and software	11	45.83	8	42.11	19	44.19
3. Reverse engineering	6	25.00	5	26.32	11	25.58

linkages with local R&D institutes and universities than those based abroad. The situation is lesser among SMEs, but there are more interfaces with the government and local business organizations.

There is not much difference when it comes to recruitment of mid-class personnel, but survey results show that more SMEs endeavour to recruit retired personnel from MNCs. (Table 38)

4.11. Most Important Partners for Innovation

Based on survey results, majority or 60% of those who responded to this question consider their respective departments, headquarters and affiliates as their foremost important partners, while considered as second most important are their local customers and/or suppliers (21.2%). This trend is true across provinces and sectors. This tendency to rely on own departments becomes even more prominent among large firms with foreign partners or equity, as an overwhelming number of joint venture firms (100%) claim to rely on their own offices and affiliates for innovation.

The same can be said of wholly foreign owned firms, with 93 percent of them or 55 out of the 59 firms of this type admitting to tap their own departments and affiliates when it comes to innovative undertaking. In relation to this, 30 percent of those 131 that responded are within commuting distance (less than 11 kilometers) to their actual partner, while the other 30 percent are more than 200 kilometers away from their network partners. It is very likely that the latter could be referring to their customers/suppliers in other regions.

Table 39. Most important partners for innovation and upgrading

	Freq	Percent
Own department, headquarters, affiliates	91	60.3
Local firm(customer or supplier	32	21.2
Local firm(competitor)	4	2.6
Local firm in the diff business field	1	0.7
MNC or JV(customer or supplier)	9	6.0
MNC or JV(competitor)	1	0.7
Foreign Internatl Cooperation Agencies	3	2.0
Govt,Public Agencies	3	2.0
Local Business Organizations	2	1.3
Foreign Universities,R&D Institutes	2	1.3
Consultants,financial institutions	3	2.0
Total	151	100.0

4.12. Obstacles to Upgrading

The absence of adequate R&D support facilities, high cost of R&D services and equipment are the two most commonly cited obstacles by surveyed firms for upgrading and innovation. These are followed by the perceived high tariffs on equipment and materials necessary for innovation. The lack of business organization or chamber of commerce which can provide training courses, seminar or testing facilities in the neighborhood was also cited.

Table 40. Most serious obstacles

	100% Foreign-owned		100% Locally-owned		Joint Venture		Grand Total
	Large	SME	Large	SME	Large	SME	
No R&D supporting Industry	5	2	2	15	3	6	33
Price of R&D support services is high	7	3	3	13	4	3	33
No university or public institute in the neighborhood	1						1
Tech. capabilities of universities or public institutes located in the neighborhood too weak to collaborate	2			1			3
No business organization or chamber of commerce which can provide training courses, seminar or testing facilities in the neighborhood	3	1	2	7	1	2	16
Protection of IPR not sufficient	1			1		1	3
High tariffs on eqpt & materials necessary for innovation	3	1	1	19	5	3	32
No tax break or accelerated depreciation system	1		1	9	2	3	16
Establishment not familiar with public support programs & procedures to apply for support measures	1			2			3
Public support programs are not designed appropriately for innovation		1				1	2
Labor mobility is too rigid for workers to bring with them technologies acquired from previous employer or from previous training	2	1		3	1		7
Grand Total	26	9	9	70	16	19	149

5. SUMMARY OF FINDINGS AND POLICY SUGGESTIONS

5.1. Highlights of Findings

The industrial cluster of the region of CALABARZON is characterized by firms located in industrial parks and those outside of special economic zones. Those within so-called PEZA locations are engaged mostly in electronics, chemicals and automotive manufacturing, while those outside are into textiles and apparel. CALABARZON has become the manufacturing center of the Philippines, while the National Capital Region or Metro Manila is increasingly specializing in services.

The survey results show that the domestic market remains important to manufacturing firms in the region. In fact, production linkages within industrial clusters, within provinces and within the region are evident, lending credence to the importance of proximity in firms' operations. Add to this the finding that the surveyed firms find their customers and suppliers as important sources of knowledge, then agglomeration effects can be claimed to be taking place. With the results showing that firms find their own capacities, including affiliates, parent companies, are major sources of new information and technology, then it can be deduced that manufacturing firms in the region rely more on their production linkages for innovative activities. This places primordial importance to the role of production networks for increasing competitiveness and productivity of firms in the country.

Only 50 out of the 205 surveyed firms, or 24 percent, claimed that they carry out R&D activities. These were comprised mainly of food producers, where coming out with new products for introduction to the market is necessary. They are followed by textiles and apparel producers in terms of absolute number but in terms of percentage among similar firms, only 16 percent engage in R&D pursuits. While apparels like shoes owned by local manufacturers have to be replaced with a new model every three months, many textiles and apparel firms in the region are assembly-type affiliates only of large firms from abroad, where everything is handed down to them, from design to the most basic raw materials.

Innovative activities of firms are mainly on process and product innovation, with nearly 60 percent of firms buying new machines or facilities with new functions to their operations. About the same percentage introduced novel procedures in their internal activities, while almost half adopted international standards. Though majority of the firms launched new products in the market, these are mainly to existing markets and utilizing existing technologies. Market-based innovation is also evident with many of the firms securing new suppliers, within and outside the country, as well as gaining new customers mainly from within the country but also significantly from other countries. The SMEs are domestically oriented when it comes to securing new suppliers and customers, while large firms were more international. These findings on the innovative activities of firms in the Philippines are aligned with the results of the survey of firms conducted in 2007 jointly by PIDS and NSO, which pointed to the fact that firms located in Greater Metro Manila[11] do innovate (Macasaquit, 2008).

The survey results also suggest that foreign firms or firms with foreign equity are keener to innovate than their local counterparts. Foreign suppliers or customers are the frequent sources of technology transfer among joint venture and/or foreign firms, second to their own departments and affiliates. This lends evidence to the widely held belief that multinational firms that dominate global FDI flows are also the principal source of innovation of most developing countries including the Philippines. These spillovers from FDIs can happen in two ways: vertical and horizontal. Horizontal or intra-industry spillover takes place between MNCs and domestic firms in the same industry. 'The deliberate transfers of training and other knowledge from the MNC to its local suppliers or affiliates'[12]—which is characteristic of most foreign or joint venture firms in developing countries—fall under the vertical technology transfers category. Under this set up, affiliates of foreign firms in host countries are not compelled to undertake their own R&D. In most cases, innovative activities are confined to basic operational capability (know-how) or simply the acquisition and training on new production equipment that may not lead to deeper technological development. Perhaps this explains why survey results showed technology acquisition is prevalent while R&D operations are relatively low (14 percent for foreign-owned firms; 40 percent for joint venture firms). This too is typical of firms engaged in the production of low-technology products.

Linkages with the traditional providers of knowledge like universities and public and private research institutions tend to be weak. Survey results show that linkages are forged with local support organizations based on 80 responses garnered, while 28 incidences of linkages occurred with universities, R&D institutes and academic societies. Local business organizations, though existing in all the five provinces in the region, did not figure in the survey as significant sources of technology. Despite the many programs being implemented by the DOST and its various instrumentalities, it seems apparent, from the survey results, that they have not reached a critical mass of firms in the region. Perhaps, the low allocation for R&D expenditures and inadequate manpower are to blame for this, but it is also possible that there continues to be a mismatch between what industry needs and what the national S&T system can offer. The inadequate linkages with the academe may also have something to do with the seeming lack of importance provided to intellectual property rights (IPR) considering that not many universities have their internal IPR systems in place. In fact, data show that only the University of the Philippines system has a Technology Licensing Office safeguarding knowledge assets generated from within. It is also quite plausible that the Philippine IPR code has not yet been fully disseminated to those concerned, or though known to many, is perceived to be anathema to the role of the university as vehicle for truth and dissemination of knowledge in society. This is due to the fact that an IPR policy is affiliated with commercialization of inventions. On the other hand, an appropriate IPR policy could respond to incentive problems in the academe, particularly in public universities, as this safeguards ownership and where revenues from the commercialization of inventions should flow into (Cristobal, 2006).

Obstacles for innovation and upgrading were likewise asked from the surveyed firms. The primary obstacles indicated by the firms were lack of R&D supporting industry and the high price of R&D support services. These were followed closely by high tariffs and equipment necessary for innovation. It is a known fact that capital outlay for R&D is definitely expensive. However, the Omnibus Investments Code and the IPPs coming out every year provides for incentives related to R&D activities, including importation of equipment (Cororaton, 2002). The reasons why this was mentioned by many of the firms should be looked into more closely but it is possible that procedures and requirements may be to blame for the few takers of these incentives, not to mention the probability that not many firms are aware of this. Patalinghug (2003) also pointed out that incentive for non-R&D activities appear to be more attractive than those offered for R&D related activities.

The absence of business organization or chamber of commerce which can provide training courses, seminar or testing facilities in the neighbourhood were also mentioned as hindrances to industrial upgrading. As earlier cited, there exist local business organizations in all of the provinces in CALABARZON. However, their presence is not much felt to the point that they can be considered sources of information and technology. Moreover, many of the firms are members of industry-based organizations with national presence like the Semiconductor and Electronics Industries in the Philippines, Inc. (SEIPI) and the Philippine Baking Industry Group as well as the Philippine Food Processors and Exporters Organization, Inc. However, among the many services offered by these organizations to their members, knowledge exchange does not seem to figure prominently, based on the survey results.

5.2. Policy Suggestions

A new movement was launched recently, in 2007 that aims to promote a culture of innovation among the Filipinos, for the Philippines and the global community. Dubbed

FILIPINNOVATION, it is a national strategy for innovation with a goal towards achieving a distinct brand for the Philippines as an Asian innovation hub by 2010. Though this vision is not likely to happen by the time line suggested in the strategy and given the nature and magnitude of challenges confronted by the Philippine S&T system, it is still laudable for outlining a strategy for innovation at the national level that was formulated via public and private partnership.[13] The National Innovation Strategy has a plan of action encompassing four strategic areas: (a) strengthening Filipino human capital; (b) supporting business incubation and acceleration efforts; (c) regenerating the policy environment for innovation; and, (d) upgrading the Filipino mindset towards a culture of innovation. Among its detailed action agenda, multi-stakeholder linkages stand out, particularly between universities and industries, not only at the domestic front but networking with regional and global centers of excellence as well (Filipinnovation, 2007).

The plan of action detailed as the National Innovation Strategy (NIS) is in fact, a well-spring of recommendations for policy that should very well be considered since these came about purportedly through a multi-sectoral, participatory approach. For one, it calls for the formation of a critical mass of institutions and experts that would promote the strengthening of technological R&D capabilities and the matching of industry needs with skills and knowledge generated at universities. Second, industry participation in collaborative activities that entail high cost like the setting up of laboratories, incubation facilities, testing centers, and standards monitoring should take effect. In fact, the Philippine Chamber of Commerce and Industry (PCCI), a participant to this effort, has committed to promote technology business incubators targeting SMEs through their chapters all over the country. Meanwhile, government support may be in the form of investments in physical infrastructure that would support business technology incubation. These facilities need not be brand-new as the government already has properties and assets that can be utilized like science complexes and dedicated manpower. The NIS even went as far as promoting the adoption of a new business incubator model that goes beyond setting up physical structures to networking with counterparts in other countries utilizing ICT for knowledge exchange. Third, having a facilitative Intellectual Property Regime acceptable to all should be had and serving as repository of innovative ideas could well inspire an innovative mind-set among Filipinos (Filipinnovation, 2007). Fear of ideas being pirated or stolen hinders inventors from publicly declaring their inventions as well as the time lag for the grant of patent applications. Having a clear concept of how the IPR code protects them and their investments could encourage more innovative activities.

Transferring ideas and inventions from shelves of scientists and faculties to factories or industries should be aggressively promoted in the country. For sure, many worthwhile endeavours are waiting to be put into action. The ITDI website lists down quite a number of enterprise modules under its Technology Transfer and Contract Projects. These are mostly for food processing but also have already developed technologies for other products. The enterprise modules are ready-to apply packages of information about the developed technologies and could be picked up for start-ups or spin offs. However, there may be a need to widely disseminate them or perhaps, matched with industry demands and absorptive capabilities to maximize utilization. This is particularly helpful to SMEs and venture capitalists looking for profitable pursuits. It could even be tied up with microfinance programs. The example of Thailand comes to mind in terms of widely disseminating such technologies, where the national S&T agency conducts road shows to promote the inventions already developed by their inventors for possible use of local firms.

However, while the creation of new knowledge and innovation through basic and applied R&D is important, it has a tendency to be cumbersome and time-consuming especially for developing countries. Perhaps, more pragmatic routes for strengthening linkages could be undertaken. Speaking of encouraging backward linkages among large firms, especially MNCs, and SMEs, the example of the Local Industry Upgrading Program of Singapore comes to mind. Launched in 1986, the program was initiated by the Economic Development Board of Singapore in order to upgrade, strengthen and expand the pool of local suppliers to MNCs. The foreign-owned firms become Partners of participating local suppliers for transferring technical, operational and managerial skills to the latter in order to upgrade their competencies enough to match their needs. Consisting of a three phase approach, the Partners first endeavour to raise the overall operational efficiency of the local suppliers; the second phase already involves introducing the local firms to the products and processes that the Partners intend for them to respond to; while the third phase already ushers in collaborative research and development. Of course, the candidate local firms would have to satisfy a number of criteria before they can be chosen under the program, foremost of which is a commitment to upgrading their operations and meeting the standards of partner foreign firms (Aldaba and Yap, 2009; Battat, et al, 1996). Intal (1997) also mentioned other similar arrangements wherein large firms are encouraged to "mentor" smaller firms like the Center-Satellie Factory System of Taiwan and the Umbrella Strategy of Malaysia.

On a more macro perspective, the fact that the route of first instance in terms of technology transfer is via FDIs, both government and private business should continue implementing programs that would encourage the inflow of investments in the country. The country should be aggressively promoted as investment haven that not only entices FDIs through incentives and rewards but with a low cost of doing business. Unfortunately, the latter remain high in the country particularly with the prevalence of corruption in many facets of the economy and society. Costs of utilities are likewise worrisome with electricity rates in the country being considered one of the highest in the region. Physical infrastructure and telecommunications, though could still be further improved, are getting better. The promotion of industrial parks and economic zones as prime locations for FDIs and domestic investments should continue but must be more dispersed to spread the gains in other parts of the country. Efforts toward categorizing areas in the country as locations for manufacturing, science parks, IT estates, and eco-tourism zones would augur well for specialization and agglomeration effects.

While transfer of technology from MNCs to domestic companies are occurring, Patalinghug (2003) reminds us that the former prefers direct investments rather than licensing of their technology particularly when new and most profitable technologies are involved. Thus, local firms, especially those not directly affiliated with the MNCs derive the technology by reverse engineering or in hiring former employees of MNCs with the requisite knowledge. In this case, scanning available local technologies may be the better route for domestic firms to come up with innovative products. Patalinghug (2003) cited the case of Pascual Laboratories which adopted and commercialized herbal products into pharmaceutical products developed by a public research institution. Wider dissemination of information and available technology and better access to them should be aggressively pursued. This requires having a well-organized repository of knowledge derived from R&D on hand that could be easily accessed by stakeholders of the local innovation system.

As for strengthening linkages between firms and universities, the importance of IPR policy should be emphasized and the formulation of internal guidelines encouraged among the latter. Having clear, unambiguous information as to where ownership of joint discovery lies would certainly encourage scientists and faculty to collaborate in a more formal manner with industries. When it comes to publicly-funded R&D pursuits, the policy is still unclear, which is why the pending bill in Congress for a law that would clarify IP ownership on government-funded research should be assessed and supported if found to be responsive to current issues and concerns. A good model on IPR management of publicly-funded research is the Bayh-Dole Act or the University and Small Business Patent Procedures Act of the United States. This legislation, in general, provided universities, small business and non-profit organizations the means to own IPR from publicly-funded research. In addition, it has provided for the right to researchers or inventors to share in the royalties arising from commercialized inventions, which should be actively pursued by these institutions. The pending bill in the Philippine House of Representatives has similar provisions, including the sharing of any income derived from the invention to the actual researchers of the innovation.

While it may not yet be possible for government to increase R&D financial allocation given its limitations, the fact that the private sector has been taking up the slack is a welcome development. In 1992 and 1996, the distribution of total expenditures was 71 and 60 percent, respectively from the public sector and 29 and 40 percent, respectively from the private sector. In 2002, public R&D expenditure only reached 28 percent, while those attributed to the private sector was 72 percent (DOST, 2004, 2009). Whatever resources that can be freed for R&D pursuits should also be efficiently allocated. In the past, priority has been given to R&D on agricultural production and technology, health and social structures. While this is understandable on the part of non-profit institutions conducting R&D, higher educational institutions should very well be providing more importance to the generation of industry-related knowledge as the government is doing. However, matching these with industry needs is equally imperative.

Meanwhile, the government S&T system should continuously undertake an assessment of its programs to enable them to determine impact and evaluate benefits vis-a-vis cost. This applies to both publicly-funded programs and projects as well as those implemented under the auspices of donors. Though they have been partnering with chambers and industry organizations to reach the industry players, they should actively be pursuing individual firms themselves to offer their services and knowledge base. This can be rationalized by the fact that productivity enhancements among firms could lead to economic growth that would benefit society as a whole. This could however, start by having a good database of firms, indicating main business activities and whether they have R&D capacities or not. There could be better targeting of limited resources if information is available. There are institutions that the DOST can partner with for the conduct of surveys of establishments, while ensuring that survey instruments are not too difficult to fill up for them.

There may be a need to also evaluate their manpower complement to ensure that there are more scientists and engineers in their midst than personnel doing administrative work. Dissemination of their programs should also be made more widespread, tapping their regional offices and various networks.

Lastly, the National Conference on Innovation started by the Filipinnovation movement should be regularly conducted to sustain public awareness and interest on S&T at the national level, so that an innovative mind-set could be nurtured among Filipinos.

NOTES

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[1] They are Project Development Officer IV, Research Specialist, Senior Research Specialist, and Supervising Research Specialist, respectively, of the Philippine Institute for Development Studies. This joint study was undertaken with general guidance and support from Dr. Josef Yap, PIDS President. The usual disclaimer applies.

[2] The bulk of this total is attributable to micro enterprises comprising 87% of total manufacturing enterprises. Employment share of micro enterprises was posted at 19% in the same period.

[3] This section draws heavily from Cororaton (2002), which was a perspective paper on the research and development policy in the Philippines.

[4] Cavite's slightly bigger land area than Rizal made it an ideal site for real estate or home developers despite the latter's close proximity to Metro Manila

[5] NSO, 2007 List of Establishments. 2007 ASPBI Primer

[6] Medalla, F. (n.d.) 'CALABARZON, the growth center of Region IV is considered the model in the implementation of decentralized local planning and project implementation'.

[7] http://www.bilaterals.org/IMG/pdf/Pamantik-KMU-_JPEPA_and_workers_in_Calabarzon_Oct_07.pdf

[8] Drawn from Blanco (n.d), 'Business and Pleasure'. Philippine Business.

[9] Medalla, F. (n.d.)

[10] PEZA stands for Philippine Economic Zone Authority, a government agency that oversees that operations of special economic zones.

[11] Greater Metro Manila includes Metro Manila, Cavite and Laguna.

[12] World Bank Report, 2008 (draft)

[13] The preparation of the National Innovation Strategy was spearheaded by the DOST, IBM, Asian Institute of Management Policy Center, and the Intellectual Property Philippines.

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