ENVIRONMENTAL REQUIREMENTS, MARKET ACCESS AND COMPETITIVENESS IN THE ELECTRONICS SECTOR: THE CASE OF THE PHILIPPINES

SUBMITTED TO

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ENVIRONMENTAL REQUIREMENTS, MARKET ACCESS AND COMPETITIVENESS IN THE ELECTRONICS SECTOR: THE CASE OF THE PHILIPPINES

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1. INTRODUCTION

Over a period of many years, the Philippine electronic industry has been the number one export earner as world demand for electronics products fuelled huge investments locating in the country. This accelerated growth and employment generation. Meanwhile, there is now a heightened awareness of the environmental impacts of the industry's operations in key export markets for the electronics products. This has led to the introduction and increasing use of environmental standards to address the considerable environmental damage and health hazards the industry may potentially cause if not well managed.

Electronic products contain a large variety of heavy metals and halogens and use lead as a bonding agent or solder. They are also considered solid wastes after their useful life. Careless disposal of used electronic products will lead to the release of hazards into the environment. The manufacture of these products also entailed use of chemicals (pollutants) that may considerably damage the environment. Poor disposal of liquid wastes has caused groundwater and soil contamination. Solid wastes with heavy metals disposal have caused the deterioration of water supplies. Gaseous emissions have affected air quality and put the health of the population at risk.

These concerns prompted voluntary and mandatory regulation at the national and the international level. Thus, many countries put forward various environmental and health policies that imposed conditions under which companies can improve their environmental performance. The new policies in industrialized countries are beginning to recognize the importance of assessing the environmental impacts from a total product life cycle view. There is increasing push for companies to pursue an integrated and systematic approach to environmental management in order to achieve satisfactory environmental performance of electronic companies.

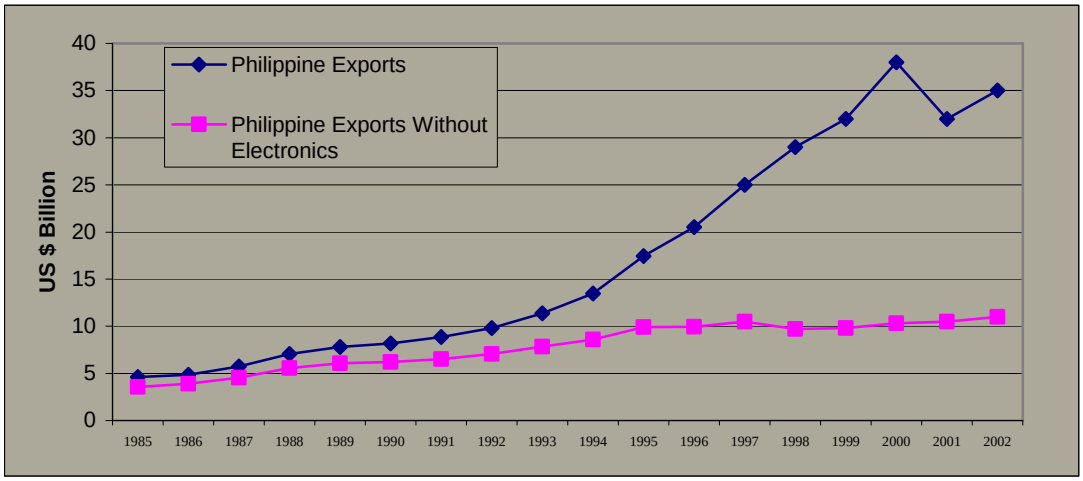
The purpose of this paper is to study how the electronics industry in the Philippines is dealing with the development in environmental and health policies in key export markets. The questions we are trying to address are: *How are the electronic companies in the developing country, particularly the Philippines, responding to the environmental and health*

requirements in key export markets? What kinds of adjustments are being adopted to improve the trade of electronic companies?

The paper first presents an overview of the electronics industry in the Philippines in Section 2. Section 3 summarizes the environmental and health issues in the industry. Section 4 identifies the environmental and health requirements in key export markets of the Philippine electronics industry: US, Japan, European Union and Singapore. Section 5 then discusses the development in environmental legislation in the Philippines to appreciate the local pressures on the industry. In section 6, the industry's awareness of the international environmental and health requirements is assessed as well as its current adjustment mechanisms. Section 7 analyzes how the industry addresses these environmental and health requirements. Conclusions and recommendations are presented in Section 8.

2. THE ELECTRONICS INDUSTRY IN THE PHILIPPINES

The electronics industry in the Philippines plays a major role in the economic development of the country. It has consistently contributed the highest export revenues since 1981. In 1990, its revenues account for only one-fourth of all export earnings.[1] Only six years after, in 1996, revenues from electronic exports already accounted for more than half of the country's total export revenues. Rapid expansion in 2000 resulted in export revenues to reach almost three-fourths of the total export revenues in the country. Exports slowed down, however, in 2001 as a result of inventory build-up and weak semiconductor and electronics demand. Strong recovery came in 2002 with more than 9% growth over the 2001 level of US $ 21.62 billion. Figure 1 illustrates the development of electronic industries from 1985 to 2002.

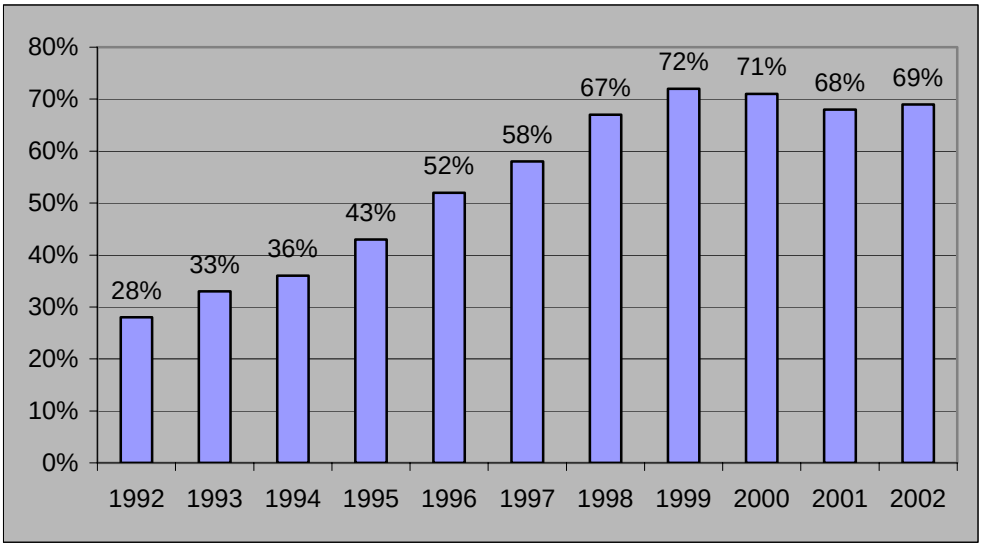


Source: Bureau of Export Trade Promotion, DTI.

Figure 1. Total Philippine Exports.

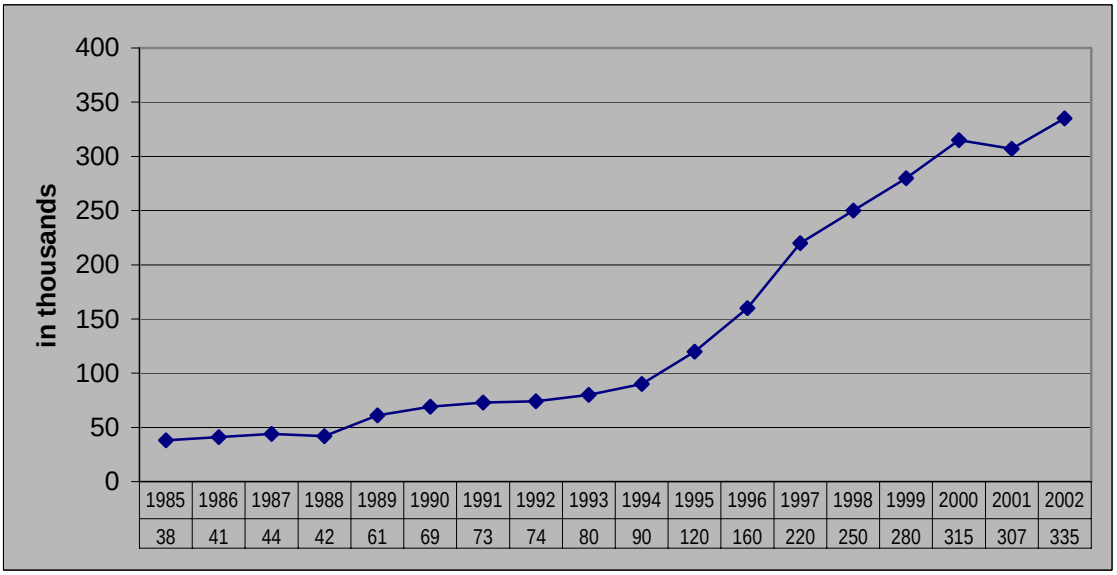
[11] Top five exports of the Philippines in 2002 include: electronics (69%); garments (6%); fresh and processed food (3%); machinery and transport (3%); and metal manufactures (1%).

The electronics industry's dynamism can be gleaned from comparing the growth rates of its exports to those of the aggregate Philippine exports. While the yearly average growth rates of electronics exports from 1985 to 1996 were 24 percent, total Philippine exports grew at an annual average of 14 percent. High growth rates are maintained through the years. Although exports contracted in 2001 from their level in the preceding year, they rebounded again the following year. These fast growth rates resulted in expanding share of electronics export revenues to the total export revenues.



Source: SEIPI. 2003. SEIPI Information Book.

Figure 2: Share of electronics revenues to total exports.



Source: SEIPI. 2003. SEIPI Information Book

Figure 3. Employment in the Electronics Industry.

In addition to providing needed revenues, the electronics industry provided an increasing number of jobs for the economy (*see Figure 3*). Employment in the sector has risen by about 33% from 1994 to1996, but slowed to about 25% from1996 to 1997. This was much higher than the growth rates of less than 10% in the early 1990s. In 1998, the industry employed about 250,000 workers, mostly operators, managers, technicians, and engineers. By 2002, about 335,000 workers are employed by the electronics industry.[2]

Investments grew by leaps and bounds to US$ 1.29 billion in 1994 and US$ 2.16 billion in 1995. This growth tapered off in 1996 (US$ 1.08 billion) and 1997 (US$ 1.47 billion). Investments then shrank in 1998 to a low US$ 670 million. It then plunged in 2002 to only US$ 270 million. Most of the investments from 1994 to 1996 were in the component and electronic data processing subsectors. These included:

- Intel Corporation's US$ 550-million investment for a Pentium microprocessor assembly and test factory;
- Fujitsu Ltd.'s US$ 124-million plant which assembles hard disk drives and optical drives (located at Laguna Technopark);
- NEC Corporation's US$ 63-million investment in a new plant to make 4-layer printed circuit boards (in Laguna);
- Amkor Anam's US $ 126-million investment in a new facility to produce ball grid array integrated circuits (Muntinlupa).

This remarkable expansion of the electronics industry in the Philippines has been spurred by the growth in demand in major markets such as the United States, Japan, Taiwan, (Province of China), Hong Kong, and European Union. In these markets, there is a growing use of semiconductors in computers, telecommunication and other consumer products. Table 1 shows the biggest destinations of the country's electronics exports.

Table 1. Key markets of Philippine electronics exports.

Country	**Market Share (%)**
United States	26 %
Japan	11 %
Europe (Netherlands, United Kingdom and Germany)	22 %
ASEAN (Thailand, Malaysia, Singapore)	17 %
Other Asia (Taiwan-Province of China, Hong Kong)	21 %
Others	3 %
TOTAL	**100 %**

Source: SEIPI. 2003. SEIPI Information Book.

[2] The data for 2002 is obtained from the website of the Bureau of Industry, DTI, accessed on September 24, 2003

The electronics industry in the Philippines comprises about 800 electronics and related companies. These companies are engaged in the manufacture of the following products: (1) components and devices or semiconductor; (2) electronic data processing; (3) consumer electronics; (4) telecommunications; (5) office equipment; (6) communications and radar; (7) control and instrumentation; (8) medical and industrial; and (9) automotive electronics. Of the total, 72 percent are foreign-owned companies, while Filipino-owned companies constitute the remaining 28 percent (*see Appendix 1*).

Industry players can be classified by product type: finished electronic product sector and electronic component sector. Companies in the finished electronic product sector comprise the large subsidiaries of multinational companies and small or medium Filipino-owned firms. This sector produces goods that are mostly absorbed by the domestic market, and hence, earns insignificant export revenues. The electronics component sector is composed of in-house and contract manufacturers. Multinational companies dominate both types of manufacturers, while the Filipino owned companies are mainly subcontractors to these large multinational companies.

Much of the vitality in the electronics industry is due to the impressive performance of the semiconductor manufacturing, which has the biggest share in total electronics exports. Contributing close to 80% of the total electronic exports, semiconductor products have kept the Philippine economy afloat during the Asian crisis. While electronics contributed 67% to the total exports, semiconductors accounted for more than half the total exports (*see Table 2*).

Table 2. Composition of Philippine electronics exports in percent.

Products	1991	1993	1995	1996	1997	1998
Total (US $ million)	2,239	3,518	7,557	10,610	14,962	19,873
Semiconductors	79	76	80	80	77	79
Electrical machinery	2	3	3	2	2	2
Telecommunications and sound apparatuses	10	11	7	7	6	4
Office and data processing machinery	5	6	6	8	14	13
Consumer electronics	5	5	4	3	2	2
Audio-visual products	4	4	3	3	1	1
Household appliances	1	1	0	0	0	0

Source: Department of Trade and Industry (DTI)

Semiconductors are made of a solid crystalline material, usually silicone, formed into a simple diode or many integrated circuits. A simple diode is an individual circuit that performs a single function affecting the flow of electric current. Integrated circuits combine two or more diodes. Up to several thousand integrated circuits can be formed on the wafer. The area on the wafer occupied by integrate circuits is called a chip or die. They are devices that transform electric signals into sounds and/or pictures, making them very important components in radios, television sets, computers, telephones and other communication and telecommunication devices. In addition to their use in consumer electronics, semiconductors are also used in major electronic equipment in industry and military. Industrial applications

include wire and radio communication devices, computer and data processing equipment and medical electronics. Military applications include satellites and missiles, radar, sonar, and various tracking systems.

The production process of semiconductors involves four main stages: wafer design, wafer fabrication, assembly, and product testing. Wafer design and fabrication are very capital intensive and are done primarily in industrialized countries. United States, European Union, and Japan are major producers of wafer. Being labor intensive, assembly and product testing have been shifting production offshore, mainly in developing countries. Thus, the semiconductor industry in the Philippines is involved mainly in assembly and product testing.

There are two kinds of firms in semiconductor manufacturing in the Philippines: (1) contract manufacturer and (2) in-house manufacturer. The contract manufacturers are responsible for the assembly of integrated circuits that will be used in the products of various end-user customers. They compete in the open market for orders for custom-designed circuits. Examples of large contract-manufacturers include Amkor/Anam and Hyundai of Korea and ASE of Taiwan. The in-house manufacturers produce integrated circuits for use in their own products. This kind of firms includes Intel, Motorola, Texas Instruments, and National Semiconductor. Increasing demand for their products led these in-house manufacturers to source assembly and product testing tasks to contract-manufacturers. While multinational companies in the local semiconductor industry are into both in-house and contract manufacturing, Filipino-owned companies are mainly into subcontracting. They are engaged in assembly and testing, wafer probe and inspection, die bonding, and wire bonding.

Table 3. Sales of Top 10 Semiconductor Companies in the Philippines.

Company	Sales (M Pesos)	Profit (M Pesos)	Gross Profit (%)
1. Texas Instruments	56,982	1,850	3.9
2. Toshiba Information Equipment	25,178	730	16.2
3. Intel Technology Philippines	14,333	2,734	23.2
4. Philips Semiconductors	13,167	893	13.2
5. Acer Information	12,081	(166)	0.8
6. Rohm Electronics	8,620	643	13.9
7. Amkor/Anam Pilipinas	8,162	710	21.9
8. Intel Philippines, Manufacturing	7,810	1,272	25.8
9. Motorola Philippines	5,788	(132)	12.7
10. Amkor/Anam Advance Packaging	3,748	1,597	47.2

Source: Business World. 2000. Top 1000 Corporations.

The global production chain for semiconductors comprises the production of the raw materials for semiconductors, assembly and product testing, and production of end-use electronic products. The raw materials include: wafers, lead frames, and wiring. Wafers used in the Philippines are produced and designed mostly in US facilities in Silicon Valley. The

end-users of semiconductors such as computers, consumer electronics, and telecommunications equipment are also located abroad. Assembly and product testing activities take place mainly in the developing countries, particularly the Philippines. Support industries include the supply of chemicals used mainly for cleaning and washing and the production of packaging. Chemicals may be obtained abroad as well as from local companies.

As the semiconductor industry in the Philippines has remained confined to the assembly and product testing activities, it has to source most of its input needs through imports. In general, the local industry imports about 95% of its inputs because the Philippines does not have the technology to produce the raw materials that meet the industry's quality requirements. Most of these raw materials are consigned by the parent company. Some are sourced from foreign suppliers on an open-account basis. Thus, there is little value-added in the exports of semiconductor devices. However, there are now indications that the country is moving beyond simply assembling and testing that have dominated the domestic manufacturing. There are semiconductor companies that already set up research and development facilities for computer-aided design, computer hardware design, and others. Others are moving towards backward integration. Intel Philippines has begun producing the Pentium microprocessor in the country. Cypress Philippines and Gateway Electronics Corporation have included wafer back grinding in its domestic production.

3. ENVIRONMENTAL AND HEALTH ISSUES IN THE ELECTRONICS INDUSTRY

The electronics industry has been considered relatively "clean" in terms of environmental impacts, compared with other industry sectors. In the United States, the industry only emits 1.6 percent of the total U.S. Toxic Release Inventory emissions annually (Microelectronics and Computer Technology Corporation 1994). But because of the tremendous growth of the industry in the world and particularly in the Philippines, the environmental impacts have grown correspondingly. Manufacturing by-products of the electronics industry and the disposition of electronic products are raising important environmental, technical, and financial issues.

The impact of the electronics industry on the environment starts with the mining of raw oil and metallic ore. In the manufacture of the final products, there are a number of processes that are accompanied by emissions to air, water or soil. These waste streams are controlled and treated at an expensive cost to the manufacturer. The industry uses different chemicals that can cause varying environmental or health problems.

Environmental impacts do not only occur in the waste streams produced in the manufacturing of the parts, components, and the final products. Effects on the environment of electronics products such as energy use, the use of natural resources, generation of pollution and solid waste occur likewise at the packaging and shipping phase, during use, and at the end of their usable life. As companies become more proactive in their environmental concern, they focus on their environmental responsibility not only within their manufacturing activities, but take responsibility for the full life cycle of the product, including the disposal stage when the

products reach the end of its useful life. Electronics products use many hazardous materials that are later released into the environment after the disposal of the used products.

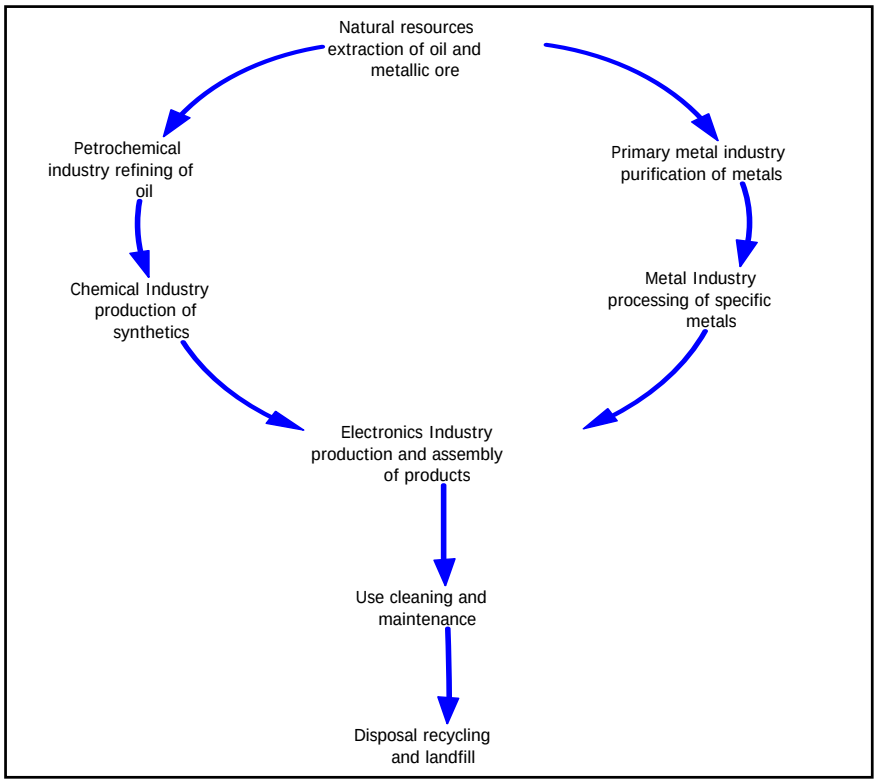


Figure 4. The life cycle of electronic products.

The health and safety issues are another important concern for manufacturers of electronics products (*see Appendix 2*). These are addressed in conjunction with environmental concerns because health concerns are associated with certain chemicals. Health concerns include the following categories: employee health and safety, contractor safety, and product safety. Health hazards can be divided into acute effects (short exposure to high concentrations of chemicals) and chronic effects (prolonged exposure to low concentrations of chemicals).

4. ENVIRONMENTAL AND HEALTH REQUIREMENTS IN KEY EXPORT MARKETS

4.1 United States

Federal environmental regulations affecting the electronics industry are the Clean Air Act and the Toxic Substances Control Act. An overview of these regulations affecting the electronics industry and of the specific chemicals used in the industry that may trigger particular regulatory requirements is presented below.

4.1.1 Federal Clean Air Act Requirements

The Clean Air Act regulates air emissions from area, stationary, and mobile sources. This law authorizes the USEPA (Environmental Protection Agency) to establish National Ambient Air Quality Standards (NAAQS) to protect public health and the environment. The goal of the Act was to set and achieve NAAQS in every state by 1975. The setting of maximum pollutant standards was coupled with directing the states to develop state implementation plans (SIP's) applicable to appropriate industrial sources in the state.

The CAA provides for a phase-out of the production and consumption of chlorofluorocarbons (CFCs) and other chemicals that are causing the destruction of the stratospheric ozone layer. Ozone-depleting substances are divided into two classes, Class I and II. The Act called for a complete phase-out of Class I substances by January 1, 2000. Class II substances consist of 33 HCFCs. The law calls for a complete phase-out of Class II substances by January 1, 2030.

On January 19, 1993, EPA issued a rule under Section 611 of the Clean Air Act that requires both domestically produced and imported goods containing or manufactured with Class I chemicals to carry a warning label. The rule covers items whose manufacture involves the use of Class I chemicals, even if the final product does not contain such chemicals. The EPA cited circuit boards, whose manufacture requires cleaning with methyl chloroform, as an example of an item of this type. Exports are exempt from this rule's labeling requirements, as are products that do not have direct contact with these chemicals. In addition, if direct contact occurs but is non-routine and intermittent (e.g., spot-cleaning of textiles), no labeling is required. Moreover, if a second manufacturer incorporates a product made with an ozone-depleting chemical into another item, the final product need not carry a label.

4.1.2 Toxic Substances Control Act

The Toxic Substances Control Act (TSCA) of 1976 was enacted by Congress to give EPA the ability to track the 75,000 industrial chemicals currently produced or imported into the United States. EPA repeatedly screens these chemicals and can require reporting or testing of those that may pose an environmental or human-health hazard. EPA can ban the manufacture and import of those chemicals that pose an unreasonable risk.

Also, EPA has mechanisms in place to track the thousands of new chemicals that industry develops each year with either unknown or dangerous characteristics. EPA then can control these chemicals as necessary to protect human health and the environment. TSCA supplements other Federal statutes, including the Clean Air Act and the Toxic Release Inventory under EPCRA.

The Toxic Substances Control Act (TSCA) applies to the manufacturers, processors, importers, distributors, users, and disposers of chemical substances or mixtures. The major sections of interest to the electronic sector are:

- Section 4, which authorizes EPA to require testing of certain chemical substances or mixtures to determine their potential risk to human health or the environment;
- Section 5, which grants EPA the authority to regulate the manufacture, processing, distribution in commerce, use, and disposal and to require testing of new chemical substances or significant new uses of existing chemical substances;
- Section 6, which provides EPA with the authority to regulate the manufacture, processing, distribution in commerce, and use and disposal of chemical substances;
- Section 8, which requires manufacturers and others to keep certain records and to submit reports to EPA;
- Section 12, which requires exporters to notify EPA when exporting certain chemicals; and
- Section 13, which requires importers to certify the TSCA status of the chemicals in an import shipment.

The major requirements that have the potential to impact the electronics industry are the development of test data, pre-manufacture notification requirements, chemical regulation, reporting and record keeping for identified chemical substances, significant adverse reactions to health or the environment.

Manufacturers, importers, and processors of specific chemicals may be required to conduct health effect, environmental effect, or chemical fate testing under a test rule or enforceable consent agreement and order. Companies subject to testing requirements may also be required to submit to EPA, unpublished health and safety studies on the chemical(s).

Any person who manufactures or imports a new chemical substance, or who manufactures, imports, or processes a chemical substance for a significant new use, must notify EPA at least 90 days before manufacturing, importing, or processing the substance. Upon review of this notice, EPA may issue an order regulating the manufacture, processing, use, or disposal of the substance. EPA may promulgate a significant new use rule regulating activities by manufacturers, importers, or processors of a chemical, either in response to a pre-manufacture notice or independently (i.e., on a chemical that is already in commerce). EPA may also require a manufacturer or importer of a new chemical or a manufacturer, importer, or processor of a chemical subject to a significant new use rule to develop test data.

The TSCA gives the EPA Administrator broad authority to issue rules regulating a chemical substance or mixture if "there is a reasonable basis to conclude" that its manufacture, distribution in commerce, use, or disposal "presents or will present an unreasonable risk of injury to health or the environment." The EPA Administrator may take a variety of actions to control or mitigate the risk posed by a chemical, including prohibiting the manufacture, import, processing, or distribution of a chemical substance. Chemicals regulated include chlorofluorocarbons, asbestos, polychlorinated biphenyls and certain substances in metalworking fluids.

Table 4. Toxic Chemicals Used in Semiconductor Packaging

Acetone	Methanol
Chromium	Nickel
Copper	Nitric Acid
Ethyl Benzene	Silver
Ethylene Glycol	Sulfuric Acid
Hydrochloric Acid	Toluene
Isopropyl Alcohol	1,1,1-Tricholorethane
Lead	Xylene

Under TSCA, any person (except a "small business") who imports, manufactures, or processes chemical substances identified by EPA by rule must report information on production volume, environmental releases, and/or chemical uses. Small businesses are required to report such information in some situations.

Any person who manufactures, imports, or processes chemical substances and mixtures must keep records of significant adverse reactions to health or the environment and must submit to EPA copies of certain unpublished health and safety studies with respect to that substance or mixture. Any person who (1) manufactures, imports, processes, or distributes in commerce a chemical substance or mixture, and (2) obtains information that reasonably supports the conclusion that such substance or mixture presents a substantial risk of injury to health or the environment, must promptly report the information to EPA, unless the person has actual knowledge that EPA has been adequately informed of the information.

A business that intends to export a chemical substance or mixture for which rules or orders have been issued under certain sections of TSCA must notify EPA within seven days of exporting or forming the intent to export the chemical, whichever is earlier, for the first time to a particular country in a calendar year.

Because the definition of "manufacture" under TSCA includes importation, importers of chemical substances must comply with all TSCA requirements applicable to manufacturers. In addition, importers must comply with an import certification requirement established by the United States Customs Service. The importer must certify for every import shipment that all of the chemical substances in the shipment (1) are subject to TSCA and comply with all applicable rules and orders, or (2) are not subject to TSCA.

4.1.3 Product Recovery and Recycling

In the US, product take back and recycling is not a very popular issue and is voluntary. The EPA has no statutory role to regulate household hazardous waste. Collection, transport, and disposal are state and local community issues. This attitude, however, has changed recently as the Environmental Health Center and the EPA have set up a body to develop new strategies for dealing with electronic wastes. This body, the US Electronic Product Recovery

and Recycling Roundtable, includes representatives from industry, government and consumer groups and aims to establish an information clearinghouse on recovery and recycling issues. Change in attitude to product take back and recycling is also due to the influence of product take-back legislation in Europe, which is exerting pressure on US companies located in the European Union.

4.2 Environmental Requirements in the European Union

Trade-related environmental policies in the European Union are of three general categories: (1) product-oriented environmental policies; (2) process-oriented environmental policies; and (3) waste management policies. The product-oriented policies view the product as directly and/or indirectly responsible for any adverse environmental effects that occur in the entire production chain. In promulgating product-oriented policies, governments focus on the electronic products as the starting point for reducing the environmental impacts caused at any point in the production chain. Hence, there are various product standards to protect the environment and health. These standards are very important to companies that export to the European Union. Imported products must comply with the product standards; otherwise penalties can sometimes be severe.

The process-oriented environmental policies aim to reduce environmental problems of production processes in specific companies. These policies may influence the international trade of electronic products. Many European industries are forced by their governments to invest in environmental protection. As a result, these companies will seek pay-off for their investments by distinguishing themselves from foreign companies, which invest less in measures to protect the environment. Moreover, they may have to pay more attention to the environmental performance of their foreign suppliers.

Waste management policies focus on reducing the environmental problems caused by discarded products and packaging materials. These policies aim to increase re-use and recycling packaging through various incentives and disincentives, such as taxes and levies, and through mandatory or voluntary restraints. It is very important for exporters to ensure that the packaging of their product complies with the waste management policies in target markets.

4.2.1 Product-oriented Environmental Policies

Electric and electronic products and parts must comply with CE (Conformitée Européene) marking of the European Union. The CE mark (meaning European Conformity) implies that the product answers to the European fundamental demands on safety and health; very few environmental requirements are set. As an instrument for harmonizing and setting technical and legal standards for products within the European Union, the CE marking aims to remove all impediments to international trade within Europe.

There are two directives applicable to electronic products. These include the directives concerning electromagnetic compatibility and low voltage products. The electromagnetic compatibility of a product means that the product can be used in a certain environment, without causing or receiving electromagnetic interference. The electromagnetic compatibility applies only to the complete product and not to the specific parts. Electronic products such as resistors and integrated circuits do not have to comply with this directive. The low-voltage legislation only makes general demands on the safety of the product. Products that are rated AC voltages between 50-1000 V and rated DC voltages between 75-1500 V must comply with this directive to be able to carry the CE marking.

The Restriction of the Use of Certain Hazardous Substances in EEE (RoHS) was passed on October 11, 2002 ordering the removal of lead, mercury, cadmium, chrome VI, and other hazardous substances from all products put on the market after July 2006. The RoHS will thus require the industry to find substitutes for lead, cadmium, mercury, hexavalent chromium, and certain flames retardants by 2006. Not only are these substitutions costly because alternatives are scarce, reliant on the time needed to change product design, but the technical challenges resulting from this induced process changes are said to be staggering. OBSERVATION: Please establish link to WEEE, because RoHS has been introduced to facilitate recycling, both from a technical and economic point of view.

4.2.2 Process-oriented Policies

In addition to obligatory environmental legislation, other instruments are being developed and put in place. These instruments work through voluntary standards or through market forces to prevent the use of substances in electronic products that are detrimental to health and the environment. Exporters do not have to comply with the requirements of these instruments, but if they do, they obtain the benefit of a potential marketing tool for their European export market.

Environmental Management Systems

The introduction of an environmental management system is one tool in a process-oriented environmental policy. An environmental management system is a management tool that provides a structure for: (1) providing a complete overview of the environmental impact of the company; (2) controlling the environmental impact of the company; and (3) reducing the environmental impact of the company. One way that companies can demonstrate their control of the environmental aspects of their production processes is through establishment of environmental management systems.

To ensure international consensus on requirements for environmental issues, a standard has been formulated, setting the requirements for an environmental management system. For this purpose, the International Organization for Standardization designed the ISO 14001 to provide guidelines for the development and introduction of an environmental management system. The objective of the ISO 14001 standard includes compliance with legislation and

demands set by the company and continuous improvement of the environmental management system and, therefore, of the environmental performance of the company. According to this standard, the environmental management system should cover the following steps:

1. environmental policy;
2. planning;
3. implementation and operation;
4. checking and corrective actions; and
5. management review.

It must be noted that the introduction of an environmental management system is not a once-only operation, but a cyclical execution of the five steps that will lead to continuous improvement of the environmental performance of the company.

One important consideration is the certification of the environmental management system. The certification allows a third party to assess whether the environmental management system of the company meets the standards set by either the ISO 14001 series or the EMAS (Environment Management and Audit Scheme). The EMAS is restricted to European companies while the ISO 14001 series is applicable worldwide. Companies seeking EMS certification are motivated to use it as a marketing instrument, an indication of their high level of environmental performance, an instrument to increase resource/material efficiency and reduce environmental compliance costs, and a tool to obtain a less stringent environmental permit more easily. It is very possible that certified companies may develop preference for ordering from environmentally sound suppliers.

Eco-labels

Eco-labeling is the practice of identifying products that reduce environmental impacts and distinguishing them from similar competing products, based on life cycle considerations—from production phase of raw and auxiliary materials, to the disposal phase of the discarded product. Eco-labeling is used as a market instrument to complement regulatory legislation for environmental protection enacted by the government. The eco-labels allow the manufacturers to show concern for the environmental impacts of their products and to communicate their environmental benefits in an objective and widely recognized way.

The European Eco-label was established in 1992 by a Council Regulation (Directive 880/92/EC of 23 March 1992). While labeling system applies in all countries in the European Union, there may be other national labeling systems running in parallel. Companies in developing countries can apply for the national or European eco-labels. To obtain the environmental label, for example in Germany, a product is judged on two aspects, namely: the various phases of the product, from ‘cradle to grave’ and the environmental damage caused by the product, such as the presence of hazardous substances. The use of eco-labels may give a foreign company an opportunity to enter a new market and serve a certain market niche. However, certification schemes for similar products may differ from country to country, making application difficult and expensive.

Eco-design (Electrical and Electronic Equipment Directive)

In February 2001, the Directorate-General of Enterprise in the European Commission (DG Enterprise) released a draft for a proposed EEE (Electrical and Electronic Equipment) Directive. The draft proposal could be interpreted to require manufacturers to design electrical and electronic equipment in a way that assesses and takes account of every environmental attribute in a product or component's life cycle, as a condition of being able to market the product in the EU. In order to place products on the EU market under the current EEE draft, a manufacturer must assess and declare that its products conform to the basic requirements in the Directive. The basic requirements include:

1. identifying the "environmental characteristics" of the product;
2. determining the "optimal design solution" while incorporating environmental aspects;
3. examining environmental aspects whenever product design is reviewed; and
4. providing information to customers and consumers on environmental characteristics.

In addition, the manufacturer is required to develop an *ecological product profile*. This profile includes: (1) identifying and estimating the magnitude of the significant environmental impacts; (2) considering the entire product lifecycle and the various environmental inputs and outputs; and (3) focusing on aspects of the product that can be influenced by product design.

Furthermore, the EEE requires manufacturers to consider design requirements that balance the requirements for environmental protection and the technical and economic requirements, while respecting health and safety legislation. This policy takes into account the following key principles: (1) prevent pollution and conserve resources; (2) make efficient use of energy and materials; (2) encourage recycling and reuse; (3) minimize release of hazardous substances; (3) optimize the useful lifetime; and (4) facilitate end-of-life management.

The EEE proposal also requires manufacturers of components or sub-assemblies to provide "all necessary information to enable another manufacturer making use of the component or sub-assembly to identify and estimate the magnitude of the environmental inputs and outputs of a product containing the component." In particular, the proposal requires manufacturers of these components of sub-assemblies to provide information on "the material composition and consumption of energy and/or resources of their components or sub-assemblies, and where available, case reference studies which concern the use and end-of-life management of the component or sub-assembly."

4.2.3 Waste Management Policies

This kind of policies centers on packaging and packaging materials. The EU Directive on packaging and packaging materials aims to:

- harmonize the differences between national legislation concerning packaging and packaging waste and decreasing their impact on the environment, without raising international trade barriers; and
- set measures regarding the prevention of packaging waste, the re-use of packaging and the recycling and recovery of packaging waste.

This Directive on Packaging and Packaging Materials sets two major demands: (1) presence of heavy metals in packaging materials and (2) the recovery of packaging wastes. There is a minimum allowable amount of mercury, lead, cadmium, and hexavalent chromium present in packaging materials. These packaging materials should be manufactured in such a way as to minimize the presence of noxious and other hazardous substances in emissions, ash, or leachate, when such packages are eventually incinerated or used as landfills.

On the recovery of packaging wastes, each manufacturer and importer must recover 50 to 65% of packaging materials brought onto the market. Although the member states are given certain freedom on how to achieve recovery of packaging materials, at least 25-45% of the packaging materials brought onto the market must be recycled, with a minimum of 15% for each material.

Waste Electrical and Electronic Equipment Directive (WEEE)

Enacted in February 2003, WEEE requires companies to provide financial guarantee to cover the collection and treatment of historic waste, based on their share of the market by product weight. In addition, companies are required to pay for waste treatment of own products that are produced from August 2005. Minimum recycling targets for products have to be met at the end-of-life treatment from 2007. The Directive requires companies to implement eco-design to minimize costs. Hazardous materials and components such as printed wiring boards will have to be separated during the end-of-life treatment. The Directive requires design for disassembly to minimize costs. The WEEE Directive also poses a significant financial burden in the form of take-back costs and the design of new products to eliminate certain hazardous substances. The industry will be required to pay for the collection, treatment, recovery and recycling of all electrical and electronics products.

German Packaging Act

The Packaging Act of 1991 passed in Germany sets no strict standards on the composition of the materials in packaging. The main concern in this Act is the obligation to take back the packaging materials for re-use and recycling. Packaging under this Act includes transport packaging, secondary packaging, and sales packaging.[3] This obligation to take back applies

[3] Transport packaging includes drums, containers, crates, sacks including pallets, cardboard boxes, foamed packaging materials, shrink wrapping and similar coverings that serve to protect the goods from damage during transport from the manufacturer to the distribution. Secondary packaging includes blister packaging, plastic sheets, cardboard boxes which allow goods to be sold on a self-service basis and prevent the possibility of theft. Sales packaging comprises the closed or open coverings of goods, such as cups, bags, blister packaging, cans, tins, drums, metal container, which are used by the consumer to transport the goods, or until such time as the goods are consumed.

to foreign firms bringing packaging into circulation in Germany. It is therefore the importers who will be subject to this obligation when they import packaging into Germany. As a result, importers could influence their foreign suppliers to use only the type of packaging imported that will meet the environmental requirements of this Packaging Act, meaning these packaging can be re-used and/or recycled.

The Duales System Deutschland (dual collection system), established to enforce this Packaging Act, provides a mechanism for companies to return sales packaging. A private company, Duales System Company, was set up to collect and process sales packaging. All sales packaging materials of manufacturers who join this collection system are marked with the Green Dot. The Green Dot logo tells the consumer that the packaging should be disposed via the dual collection system. For exporters of products from developing countries, the disposal of transport packaging is the more relevant concern than sales and secondary packaging.

The New Packaging Act, enacted in 1997, is very similar to the old one. The main differences, which may be relevant to exporters in developing countries, are the definition of packaging and the recycling quota. The main priority of the New Packaging Act is to avoid packaging waste. The Act stipulates that 65% (by weight) of the packaging waste should be recovered, of which 45% (by weight) by means of recycling. Packaging should be manufactured in such a way that: (1) the volume and weight of packaging is minimized, within the necessary level of safety and hygiene of the packed product and for the consumer; (2) the re-use and the recovery of the packaging materials remain possible, and that the environmental impact of packaging waste operations are minimized; (3) the presence of noxious and other hazardous substances in emissions, ash or leachate is minimized.

4.3 Environmental Policy and Legislation in Japan

4.3.1 The Basic Law for Promoting the Creation of a Recycling Oriented Society

In July 1999 the Industrial Structure Council (ISC) predicted severe pressures on landfill and recommended the vision of a recycling oriented economy. A key concept of this was the implementation of the 3Rs (reduce, reuse and recycle) with emphasis on waste reduction and resource reuse. In 2000, the parliament amended or enacted six laws related to waste management and recycling. In June 2000, the Basic law for Promoting the Creation of Recycling oriented Society and the Law for the Promotion of Effective Utilization of Resources (LPEUR) were put in force.

4.3.2 The Law for the Promotion of Effective Utilization of Resources (LPEUR)

The LPEUR states that the competent Minister should promote: (a) reduced generation of used products and by products; and (b) effective utilization of recycled resources and reusable parts. The law prescribes shared responsibilities and 3Rs measures. In March 2001, seven new industries and 42 new product items were designated by the ordinance as subject

to the provisions of the law. This increased the designated industries from three to ten and the number of products from 30 to 69.

The seven key categories and manufacturers (and importers) responsibilities covering home appliances, office equipment and electronics related products are as follows:

- designated resources-saving industries are required to minimize by-product production;
- designated resources- reutilizing industries(design for reuse) are required to take measures to use recyclable resources or reusable parts;
- specified resources-saving products (design for waste reduction) are required to take measures to rationalize raw materials, prolong product life and to reduce the generation of "end of life" products;
- specified resources-reutilized products (design for recycling) are required to promote the use of recyclable resources or recoverable parts by designing and manufacturing products that can be reused and recycled;
- specified labeled products are required to label their products to facilitate separation;
- specified resources-reconverted products are required to take measures toward the recovery and recycling on their behalf; manufacturers and importers that use batteries as a constituent part of their products must take autonomous measures to recover the batteries; and
- for specified by-products producers are required to take measures to use by-products as recyclable resources.

LPEUR effectively makes eco-design obligatory for electronic products. It imposes an obligation on manufacturers and importers to recover and recycle resources.

4.3.3 Household Appliance Recycling Law

The Household Appliance Recycling Law (HARL) was enacted in May 1998 and implemented in April 2001. HARL deals with the recycling of large consumer electronic products particularly home appliances, including televisions and personal computers. Local governments are the principal collectors of these items for charging user fees. Consumers could bring unwanted appliances to stores where they will be accepted for recycling. Users of the products would shoulder the recycling costs.

The Law also promotes research, development and testing of recycling technologies and the creation of products using recycled materials. Specific laws promoting recycling in automotive, food and building sectors were also enacted.

4.3.4 The Green Purchasing Law

In June 1995, the cabinet adopted the Action Plan for Greening Government Operations. The plan requires that government activities become more environment friendly through the use

of recycled paper and energy-saving equipment, the introduction of lower emission vehicles, and the reduction of CO2 emissions at all government facilities. The Environment Agency of Japan has proposed the creation of an Acid Deposition Monitoring Network in East Asia. Japan actively promotes regional programs such as global warming, biological diversity, acid deposition and marine environment.

In April 2001, the Green Purchasing Law (GPL) was passed to "green" the demand side of central and local government purchasing. This is stimulating the development of greener office equipment and other products, resulting in the establishment and dissemination by many companies of green procurement guidelines to suppliers. Many companies also have formed alliances with suppliers in key supplier market.

4.4 Environment Policy Development in Singapore

The Poisons Act and the Poisons (Hazardous Substances) Rules provide controls over the Import, Transport, Storage and Use of Poisons or Hazardous Substances. The aim of the controls is to ensure that these Poisons and Hazardous Substances are properly managed and handled at all times to avoid endangering life, property and the environment. Under this Act, individual chemicals and 14 classes of chemicals are classified as poisons or hazardous substances for control. These include chemicals that:

- pose a mass-disaster potential e.g. chlorine, ammonia;
- are highly toxic and pollutive e.g. cyanides, phenol, pesticides; and
- generate wastes that cannot be safely and adequately disposed of, e.g. polychlorinated biphenyl, chlorobenzenes.

Holders of licenses, permits or written permissions issued by PCD under the Poisons Act, the Clean Air Act, the Poisons (Hazardous Substances) Rules or the Trade Effluent Regulations need not apply for a fresh license or permit under the EPCA and regulations as their existing licenses, permits or written permissions will continue to be valid until their expiry dates.

5. DEVELOPMENT OF ENVIRONMENTAL AND HEALTH POLICIES AND LEGISLATION IN THE PHILIPPINES

5.1 The Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990

In 1990, Pres. Corazon C. Aquino signed Republic Act No. 6969 also known as the Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990. This Act covers the importation, manufacture, processing, handling, storage, transportation, sale, distribution, use and disposal of all unregulated chemical substances and mixtures in the Philippines, including the entry even in transit. The Act also includes the storage and disposal of hazardous and nuclear wastes into the country for whatever purposes. The Department of Environment and Natural Resources shall be the implementing agency of this Act.

An Inter-agency Technical Advisory Council attached to the Department of Environment and Natural Resources was created and is composed of 10 department representatives and a non-governmental organization on health and safety representative. The council shall have the following functions:

1. to assist the Department of Environment and Natural Resources in the formulation of the pertinent rules and regulations for the effective implementation of this Act;
2. to assist the Department of Environment and Natural Resources in the preparation and updating of the inventory of chemical substances and mixtures that fall within the coverage of this Act;
3. to conduct preliminary evaluation of the characteristics of chemical substances and mixtures to determine their toxicity and effects on health and the environment and make the necessary recommendations to the Department of Environment and Natural Resources; and
4. to perform such other functions as the Secretary of Environment and Natural Resources may from time to time, require.

The penalty of imprisonment of six (6) months and one day to six (6) years and one day and a fine ranging from six hundred pesos (PhP600.00) to four thousand pesos (PhP4,000.00) shall be imposed upon any person who shall violate section 13(a) to (c) of this Act and shall not be covered by the Probation Law. If the offender is a foreigner, he or she shall be deported and barred from any subsequent entry into the Philippines after serving his or her sentence.

In case a partnership, corporation, association or any juridical person, the partner, president, director or manager commit any violation of this Act and shall knowingly tolerate such violation shall be directly liable and responsible for the act of the employees and shall be criminally liable as a co-principal. In the case of corporations or other associations, the above penalty shall be imposed upon the managing partner, president or chief executive in addition to an exemplary damage of at least five hundred thousand pesos (PhP500,000.00). For foreign firms, their director and all officers shall be barred from entry into the Philippines, in addition to the cancellation of their licenses to do business in the Philippines.

5.2 The Philippine Clean Air Act

The Philippine Clean Air Act (R. A. No. 8749) aims to address air pollution from mobile, stationary, and other sources. The Act mandates the formulation of an Integrated Air Quality Improvement Framework (IAQIF), and an Air Quality Action Plan (AQAP). Although these are separate documents, they have to be prepared simultaneously with the Implementing Rules and Regulations (IRR) to ensure their consistency with the IRR.

The Salient Features of the Act are:

1. *The establishment of an Air Quality Management System that would include the following:* Air Quality Monitoring and Information Network, the Integrated Air

Quality Improvement Framework, the Air Quality Control Action Plan, airsheds, the management of non-attainment areas, air quality control techniques, ambient air quality guideline values and standards, emissions charge system, an air quality management fund, air pollution research and development program, air pollution clearance and permits, emission quotas, financial liability for environmental rehabilitation and emissions trading.

2. *Prevention and control of pollution from stationary sources:* emissions standards, the establishment of an environmental management system and the installation of air pollution control devices.

3. *Prevention and control pollution from mobile sources:* DOTC to implement emission standards, manage a motor vehicle inspection system (MVIS), issue certificates of conformity for new motor vehicles.

4. *The execution of a ban on incineration and the phase-out of incinerators used to burn hospital and medical wastes within three years.*

5. *Specification of standards for fuels, additives and fuel-related products.*

6. *Institutional Mechanisms*: DENR shall be the primary agency responsible for the implementation and enforcement of the CAA; the conversion of the Environmental Management Bureau (EMB) from a staff to a line bureau under the DENR, and strengthening the roles of local government units, NGOs and people's organizations as members of multipartite air management governing boards.

7. *Administrative Action and citizen suits, suits and strategic local actions against public participation (SLAPP).*

8. *Phase-out of harmful substances.*

9. *Fines and penalties.*

The main provisions of the Implementing Rules and Regulations include operational guidelines for the establishment of an Air Quality Management System, an incineration ban, the phase-out of the medical incinerators, emission standards for pollution from stationary and mobile sources, a permitting system, recognition of Environmental Management Systems (EMS) as a means to comply with the Clean Air Act, standards for fuels, additives and fuel-related products, conversion of the Environmental Management Bureau (EMB) from a staff to a line bureau under the DENR and the strengthening of the roles of Local government units (LGUs), non-government organizations (NGOs) and people's organizations (POs).

6. LOCAL AWARENESS OF INTERNATIONAL AND NATIONAL ENVIRONMENTAL AND HEALTH REQUIREMENTS

Global trends in trade and investments continue to have considerable impact on the Philippines. Over the years, the country has shifted from nationally based industrial production to global and horizontal processing and assembly of components, making its economy just a unit of the global production cycle. The Philippines, therefore, has become vulnerable to competition from other countries that could provide better business services. This is particularly the trend in the Philippine electronics industry. Most existing electronic industry facilities in the country are wholly owned subsidiaries of the leading electronic companies around the world, particularly the developed countries. As the electronic industry is considered the most preferred industry in the country, the challenge is to attract the global electronic companies to venture in the Philippines instead of other Asian countries. The competitiveness of the country, however, depends on its responsiveness to the needs and demands of its global economic partners.

Effective environmental management is becoming a major factor in the locational decision-making of foreign electronic businesses. Due to the strict enforcement of environmental laws in their parent countries, electronics companies, intending to put up labor-intensive assembly and testing activities in other countries, are attracted to countries that observe local and international environment and health standards in order to balance economic growth and environmental considerations. The Philippines has, already in place, relevant and strict environmental laws and policies to safeguard the environment and health of its citizens. Implementation of these laws and policies, although supportive of the electronics companies' environment and health requirements, may result in additional cost burden especially to small and medium enterprises (SMEs) engaged in the manufacture of electronics in the Philippines. These SMEs, which provide substantial employment to Filipinos, would have difficulty competing in the global market.

Hence, it is important to understand how local electronics industry players respond to environmental and health standards of the global economy. First let us review the mechanism by which domestic electronics companies get to know various environmental and health requirements in their key export markets.

6.1 Information System

Knowing the relevant legal requirements is a critical step to compliance. Philippine electronics companies get their information on local legislation from government agencies, industry groups, and professional organizations. Companies that are members of business networks avail of training and information through consultations and conferences. The Philippine Business for Social progress and the Philippine Business for the Environment are two major organizations that provide training and advocacy support to the companies.

One industry group that provides relevant information to the electronics industry is the Semiconductor and Electronics Industries in the Philippines, Inc. (SEIPI), particularly in

upgrading the skills of its workers. SEIPI is the leading and largest organization of electronics companies in the Philippines. From only 13 companies in its first year in 1984, SEIPI membership has now grown to 192 members. SEIPI serves as the center for information on the Philippine semiconductor and electronics industry and exchange of ideas from around the world. To make this happen, SEIPI has established linkages with a number of semiconductor and electronics industry organization from countries such as Japan, Australia, Hong Kong, Korea, Taiwan, Singapore, Malaysia, Israel, France, and Germany. Likewise, SEIPI established representations in various government offices in the Philippines.

Information dissemination on strategic topics of the electronics industry takes place in any of the seven Networking Committees (NWCs) of SEIPI, which cover functional areas of member companies. These are environment and safety, engineering, purchasing, human resources, finance, traffic, and information technology. The NWCs serve as platforms for benchmarking and exchanging ideas among midlevel managers of the various member companies. The NWCs develop training modules for the upgrade of skills and knowledge of members. The NWC for environment and safety, for example, conducted, in 2002, trainings on waste minimization, updates on the proposed Clean Water Act, hazards and health effects of chemicals, and hazardous conditions in the workplace.

Another avenue for identifying relevant environmental and health requirements is through the corporate headquarters. Parent companies provide their Philippine subsidiaries with regular information on international environmental laws and standards and on how to respond to them. Many parent units allocate resources on research and development, partly to keep them informed of such standards. The subsidiary of National Panasonic conducts its own research on existing and proposed local and international environmental standards, in addition to the information provided by its parent company.

Another multinational company convenes a monthly EHS policy meeting for top EHS people from different subsidiaries located in various countries around the world. Experts in the US and their counterparts in Europe, who work closely with the policy-making groups of these countries, provide updates to their regional counterparts on various developments in environmental and health policies and legislation. The local counterparts likewise alert the group of new environmental and health policy development taking place offshore the corporate headquarters. In these meetings, the group reviews such policy developments as to how they will affect the operation of the company.

The Philippine electronic companies, in turn, provide employees seminars and trainings to familiarize the engineers and operators on new requirements. Employees are given EMS manuals to familiarize them on the EMS the company is undertaking. They also maintain a website about their EMS. Training and seminars are done regularly, usually on a monthly basis, at all levels of employees. National Panasonic even sends its employees to Japan to study the technology and processes that can be adopted in its Philippine counterpart companies. Most electronic companies are provided training on best-known methods of manufacturing (JIT, TQM, 5S, QPIC, Kaizen, Daimyu, etc.)

Many electronics companies are now increasing their efforts in supply chain environmental management (SCEM). European legislation and, possibly, now the Japanese Law for the Promotion of Effective Utilization of Resources and the Home Appliances Recycling Law that require electronics manufacturers to recycle their products at the end of their useful life, are forcing companies to work closely with their suppliers to put in place product take-back schemes. The focus on integrating environmental management in the product life cycle is encouraging companies to expand their SCEM practice beyond first-tier suppliers to reach second- and third-tier suppliers. Hence, corporate headquarters with ISO 14000 certification requires their Philippine subsidiaries to be ISO compliant. It is most likely that the local subsidiaries or contract manufacturers would demand the same requirement to their suppliers on a case-to-case basis. An important component of the SCEM is the training activities for the suppliers to allow them to establish their own environment management systems. Hitachi identifies suppliers that have EMS, which helps in targeting non-performers. The large companies put in resources to build the capacity of the SMEs to develop and implement their own EMS through training, mentoring, and technical assistance.

One possible mechanism through which information on standardization in the electronics industry is the participation of the Bureau of Product Standards, which is a governmental agency under the Department of Trade and Industry (DTI). DTI, including the Department of Health and the Department of Agriculture, is responsible for standards development and implementation in the Philippines. The Bureau of Product Standards (BPS), the country's national standards body, develops, implements, coordinates, and promotes standardization activities in the country.

As active member of the International Organization for Standardization (ISO) and International Electrotechnical Commission (IEC), BPS participates in many of their technical committees. BPS represents the country in ISO General Assembly meetings, where important policy decisions governing international initiatives are made. Likewise, BPS attends the annual meeting of IEC. Technical committees of BPS review various international standards and assess their adoption to the local setting. The harmonization of Philippine National Standards to relevant international standards has focused on information technology standardization. There is little involvement yet on environmental standardization, except of course the adoption of the ISO 14000 standards to the national standards.

The BPS is also very active in regional standardization. It is an active participant in the activities of the Pacific Area Standards Congress, a forum that strengthens and supports the international program of ISO and IEC. It commenced in 1993 the implementation of the ASEAN Consultative Committee on Standards and Quality. Member countries of ASEAN are involved in various measures such as the harmonization of standards, laboratory accreditation and the reciprocal recognition of test results, and certification of products and quality systems to remove technical barriers to intra-ASEAN trade. Another participation of BPS in regional standardization is the Asia Pacific Economic Cooperation (APEC) Sub-committee on Standards and Conformance. The Committee agreed to reduce costs, facilitate trade, and improve efficiency of administrative processes related to trade in the region through:

- ensuring the transparency of standards and conformity assessment of APEC economies;
- aligning of APEC economies mandatory and voluntary standards with international standards;
- establishing mutual recognition among APEC economies of conformity assessment in the regulated and voluntary sectors; and
- promoting cooperation for technical infrastructure development to facilitate broad participation in mutual recognition arrangements in both the regulated and voluntary sectors.

6.2 Environmental Management Systems

The global growth and expansion of the electronics industry may cause environmental damage if not properly managed. Liquid and solid wastes have caused ground water and soil contamination while gaseous emissions have caused respiratory and other health problems. The global environment and health standards for the electronics sector focus on its use of hazardous materials in its products and its production and its disposal of wastes including the disposal of obsolete electronic products. Companies, through effective environmental management programs, address these standards.

ISO 14000 is a series of voluntary standards and guidelines on environmental management systems published by ISO. The aim is to provide all industries with a structure for environmental management system (EMS) that will help ensure all operational processes are consistent, effective and will achieve the stated environmental objectives of a given organization. ISO14001 or the Environmental Management Systems-Specifications with Guidance for Use is the first standard in the ISO 14000 series. The Philippines adopted this into the Philippine National Standards (PNS) 1701.

ISO 14001 is considered the framework for integrating environmental management with the overall business management activity. It allows an organization to achieve its environmental objectives, targets and programs through internal performance based policies and procedures. It also serves as a tool for auditing the organization's conformance to relevant legislative and regulatory requirements. Although ISO 14001 does not replace any federal, state or local environmental laws and regulations, adherence to it has become a prerequisite to suppliers as it provides an important benchmark for corporate environmental practices. As early as March 1997, Philippine companies started being certified by third party auditors to ISO 14001 standards and many are currently being certified or on the path to certification.

Philippines electronics companies often claim that they are knowledgeable of the international and local environmental and health standards because they are certified to the ISO 14001 standards. This is because ISO 14001 expects organizations to comply with existing national legislation and international environmental agreements. Thus, ISO 14001 requires updated proof of permits, regular emission and discharge records, etc. Furthermore, ISO goes beyond regulatory compliance and promotes proactive approaches to managing environment affairs.

When asked for specific environment and health standards of local and key export markets, individual company managers refer to environmental laws. They are usually familiar with the Wastewater Act (DAO 34 and 35), Solid Waste Act, Clean Air Act (RA 8749) and the Hazardous and Radioactive Chemical Waste Act (DAO 9229). They are very familiar with IEE, ECC and EIS requirements of local government agencies as well as EU's lead free and Japan's green products requirements.

6.3 Pressure for Environment Friendly Products and Operations

The Philippines has a complex legal framework for environmental protection. Compliance to various national environmental requirements is necessary for business operations. Yet, electronics companies claim that these regulations are poorly enforced and are sometimes ignored to attract foreign companies to invest in the country. The companies claimed that compliance with environmental standards has originated from the environmental policies imposed on them by their parent companies. While the production cycle of the industry is fragmented but integrated, governments tend to look at the whole chain and demand these units to comply with the standards. Furthermore, the environmentalist stance of major consumer groups in key export markets exerts pressures to the parent units for environment friendly products and production. Thus, the global electronic industry's consciousness of its environmental impacts makes it the primary factor for Philippine electronic companies to adhere to environmental and health standards. Changes in policies on production in the parent company resulting from environmental and health legislation automatically apply to its subsidiaries.

In the same manner that parent companies demand from its subsidiaries to be environmentally conscious, subsidiaries in turn demand, from their suppliers, compliance to environmental standards. Recognizing the burden of such requirements to suppliers, the Philippine electronics subsidiaries provide training and equipment supply to their suppliers and even monitor the operations of their suppliers. Thus, for contract manufacturers in the Philippines, the pressures for environment friendly production and products come from the company that will use the products.

6.4 Responses to Environmental Requirements

Initial efforts of Philippine electronic companies on environmental impact started with pollution abatement through proper waste disposal measures and search for alternatives to incineration and landfill. Recent efforts now focus on re-designing production processes and products by reducing the use of toxic substances, developing low-waste electrical and electronic products, and developing products that are easy to disassemble for recycling purposes. Solid waste management through waste segregation and recycling is the most common approach especially for Japanese subsidiaries. The greater challenge is on recycling obsolete electronic products, as this requires a system for disposal and collection or a take

back scheme. It also requires processing of collected electronic wastes into waste residues and secondary materials for re-utilization.

National Panasonic, a subsidiary of Matsushita Electric of Japan, follows its parent company's Green Product promotion through green procurement, product design, production engineering, technology development, and product assessment. It is already thinking of a take back system for its products. It boasts of clean manufacturing through its zero waste recycling efforts. Amkor/Anam Philippines uses state of the art environmental and waste management technology and techniques in manufacturing electronic products.

Matsushita Electric has developed global lead free soldering ahead of its competitors and National Panasonic claims that it has a product that is totally lead free. Rohm Philippines said that its printed circuit boards no longer contain lead. Vishay Philippines claims that the lead content of its products is below the 40 ppm level or almost lead free. With newer technology in the future this could be brought down to negligible limits.

Electronic companies located in export zones like Sta. Rosa Laguna Technopark are provided with good infrastructure facilities for waste treatment and disposal system, piped water supply, etc., wherein the companies benefit from economies-of-scale. Vishay Philippines, however, contracts out to certified companies the disposal of its wastes. National Panasonic said that the non-existence of landfill forced them to resort to incineration. With the Clean Air Act ban on incineration, the company stopped the use of incinerators and looked for alternative ways of waste disposal. It currently launched anti-smoke belching campaign in compliance with the Clean Air Act.

Intel Philippines follows the US standards for packaging and has substituted solvents used for cleaning for de-ionized water. It has stopped the use of Freon in its production processes. Texas Instruments, the number one semiconductor exporter was said to be the first to get ISO 14001 certification followed by National Panasonic. It uses palladium frames instead of lead frames and has corporate guidelines for zero waste disposal.

All the companies interviewed claimed that they are regularly monitored and audited by certified laboratories for environmental compliance. They have their own research and development to continuously improve their products and production processes. All of them also admit that they have little experience of being monitored or receive support from the Philippine government in terms of implementation of these standards. They are not familiar with any incentives provided by the government for environment compliant companies.

7. ADDRESSING INTERNATIONAL ENVIRONMENTAL AND HEALTH REQUIREMENTS

Electronics products comprise the largest portion of the Philippines exports. Changes in the international trade of these products will produce a web of changes in the country's economy, from foreign exchange earnings to employment. Increasing pressure to produce green electronic products will affect the competitiveness of the local electronics industry. The analysis will not be an empirical investigation since there are not enough statistics to

understand the environmental regulation-competitiveness nexus for the local electronics industry. The focus of the analysis will be more on the potential impacts in terms of the adjustments made by the companies in response to these environmental and health requirements.

The analysis must first take note of two important factors. First, it will be noted that the production chain of electronics products involves varying companies located in different geographical and political areas. The manufacture of electronics products occur in a diverse and fragmented manner. From a global production chain perspective, manufacture of electronics proceeds in an integrated system that eventually results in a complete electronic product. Second, environmental policies in developed countries reflect a holistic approach of managing the environmental impacts of the electronics industry. The focus is on considering the environmental impacts of the entire product life cycle, from extraction of raw material, to the production of the product, to the final disposal of the product, including the impacts of the parts produced from foreign suppliers.

Pressures for producing green electronics products come from mainly two sources, the government and the consumers. As seen in the previous sections, governments have been issuing a number of policies for emissions, effluents, and the disposal of wastes. Consumers, mainly from developed countries are clamoring for more environmentally friendly electronics products. Consumer pressures are directed mainly at the manufacturers located in developed countries. Recent government policies are now designed to correspond to the cradle-to-grave view of addressing environmental impacts. This means that manufacturers will have to consider their pollution effects beyond their production processes. Because of this, manufacturers of electronics products may pass on this pressure to their suppliers located abroad and require them to make relevant adjustments in production to meet environmental requirements.

The kind of adjustments to be made by electronics companies in the Philippines would depend on these pressures from developed country governments and the manufacturers of electronic products that source theirs parts from suppliers in the Philippines. Such adjustments in production and consumption patterns will differ in the two groups of electronics companies located in the country, the subsidiaries and contract manufacturers.

7.1 Subsidiary Manufacturers

The adjustments made in subsidiaries located in the Philippines depend on the production and consumption changes adopted by their parent companies. Although located in a different country, subsidiaries apply the same policies adopted by their parent companies. Any changes in the policies of the parent companies as a result of environmental and social legislation will automatically apply to the subsidiaries.

An example of this is Intel Philippines' adoption of EHS policies by its parent company. Intel Corporation implemented a number of programs to improve health and safety performance. The company emphasized that these programs must be incorporated from the

design phase forward. Intel Corporation, thus, began the use of the Design for Environment, Health and Safety as a tool to facilitate an injury- and incident-free manufacturing environment. By addressing EHS concerns in the design stage, potential problems are avoided instead of reacting to the problems after they occur. Adopting a proactive response to EHS issues, Intel Philippines became a model of workplace safety and health in the country. In recognition for its excellent performance in health and safety, the Department of Labor and Employment (DOLE), in 2002 awarded Intel Philippines national recognition of excellence: the *Gawad Kaligtasan at Kalusugan Institutional Award*. This is not the first award; but the site has been receiving a number of awards for its excellent performance in health and safety (Intel 2002).

National Panasonic adopts the Green Product Promotion of its parent company in Japan, Matsushita Electric. National Panasonic is implementing this policy through green procurement, product design, production engineering, technology development, and product assessment. There is now a plan of establishing a take back system to increase the company's recycling efforts. It boasts of clean manufacturing through its zero waste recycling efforts. National Panasonic follows lead free soldering policy of its mother company. It claims to manufacture its product totally lead free.

In many cases, the environmental requirements a parent company has to meet are generally harsher than those policies found abroad where the subsidiaries are located. In other cases, however, local regulation may be stricter than the current corporate policies. Applying current corporate policies may result in a subsidiary not in compliance with the domestic environmental requirements. This was the case when the Clean Air Act was enacted in 1999 in the Philippines, which contains air emission standards that are apparently difficult to attain. Intel Corporation follows a principle of complying with the harsher local regulation. Active participation of Intel Philippines in the development of local regulation influences the formulation of reasonable and realistic standards.

7.2 Contract Manufacturers

Automatic adoption of corporate policies by subsidiaries will no longer apply in the contract manufacturer mode where suppliers and users are two different companies. The influence on contract manufacturers to comply with environmental requirements of developed countries comes from the buyers. European customers that have to meet the legislation to recycle their products at the end of their useful life are forcing them to work with their suppliers to achieve such take back requirement. These buyers will have to impose improved performance and environmental standards on their suppliers. This response to new legislation in Europe and Japan on recycling products is resulting in environmental supply chain management. This is leading to varying initiatives that change the production and consumption patterns of contract manufacturers in order to meet the requirements of environmental legislation.

Buyers require suppliers to establish environmental management system and to certify its system according to the ISO 14000 standards. Certification requires substantial monetary

resources, which is not within the reach of small contract manufacturers. For large multinational contractors, ISO 14000 certification is achievable. Buyers may use ISO 14000 certification as a qualifying criterion in selecting suppliers. At Xerox, suppliers must commit to fulfill the company's supplier EHS requirements before they can be an approved vendor. Intel implements a pre-qualification process for contractor safety that assures high safety standards.

But after building good relationships, changing suppliers to meet environmental requirements is not an easy thing to do. Instead of sourcing suppliers using environmental criteria, the challenge is how to assist existing suppliers achieve environmental standards. These manufacturers must invest in supplier training programs to improve environmental performance of suppliers. Oftentimes, they have to be closely involved with their supplier's environmental programs, such as Texas Instruments (TI) Philippines' monitoring process of its suppliers and assisting them comply with the standards of TI. It is now being increasingly recognized that the success of manufacturers will be incomplete without improvements on the part of their suppliers as well.

The increasing pressures from government and consumer groups to enhance environmental performance force manufacturers to expand involvement with suppliers even at the design phase. Minimizing the end-of-life environmental burdens of products will require a strong emphasis on product design goals for minimal environmental impacts. Hence, not only does design for the environment mean fewer hazardous substances and more recycled and recyclable materials, it also means stronger participation of suppliers even early at the design phase. Suppliers participating in the design process are exposed to new techniques and technology, resulting in reduced risk potential from hazardous wastes. This will allow suppliers to develop a competitive advantage in a market seeking a new approach to design and manufacturing.

Early interaction with the suppliers on initiatives to reduce environmental impacts offers greater interaction opportunity for customers and suppliers to exchange ideas on environmental improvements. The resulting discussion will spark ideas for win-win solutions. The annual Materials Supply Day sponsored by Intel provides suppliers opportunity to discuss various supplier issues and to facilitate exchange of strategies for EHS management.

Contract manufacturers in the Philippines may take some time before they can improve their capabilities to meet global environmental and health, standards despite initiatives on environmental supply chain management. Manufacturers in other developing countries may develop their capability faster than the players located in the Philippines to meet global environmental requirements. This could encourage buyers to switch to suppliers in other countries, which are becoming aggressive in attracting potential investments and are getting ahead in establishing waste management facilities. This is potentially threatening for contract manufacturers in the Philippines, especially for small contractors that are not able to meet financial burdens of changing production processes and investing in cleaner technology to improve environmental performance.

7.3 Developing local waste management capability

One factor that will affect the sustainability of the electronics industry in the country is its local waste management infrastructure. SEIPI believes that the local waste management capability in the country should be developed to meet world-class standards if the electronics industry is to remain competitive and attractive to existing and potential investors. The semiconductor industry generates a substantive amount of hazardous wastes whose treatment and disposal costs are becoming so significant that investors now evaluate financial feasibilities and cost of waste management as part of a standard feasibility assessment in deciding to invest.

The lack of local waste management facilities that meet international standards forces the electronics industry to employ either of two alternatives in addressing their hazardous waste: (1) store them indefinitely in waste storage facilities or (2) ship waste to offshore disposal sites. Exporting hazardous waste is costing companies an average of US $ 2,000 per metric ton (SEIPI, 2002). In addition to high cost, there is a potential threat of environmental accidents from long-term storage as well as transportation over great distances. SEIPI prioritizes the following concerns to improve the country's waste management infrastructure:

- lack of local treatment, storage, and disposal facilities that meet international standards;
- inadequate local capability to treat all types of waste streams generated by the industry because of lack of specific technologies to treat these waste streams;
- absence of central repository of all information on hazardous waste management;
- lack of inter-agency and industry cooperation to develop local waste management solutions.

The other Asian countries are realizing much earlier the big role of waste management in cost competitiveness in the electronics industry. As a result, these governments are getting ahead of the Philippines in providing appropriate support to promote the construction of important waste management infrastructure. The Malaysian government led the development of centralized hazardous waste treatment, storage, and disposal facility in Kualiti Alam, while providing incentives for recycling facilities. In Singapore there are a number of facilities that process hazardous waste in the country. China has also started to develop a number of world-class facilities that will cater to the needs of industries. Hong Kong has a centralized waste treatment facility for waste management requirements of industries operating in the country.

7.4 Philippine Environmental Partnership Program (PEPP): Environmental Agreements between the Government and Industry

The Philippine Environmental Partnership Program (PEPP) aims to advance self-regulation as an approach to improve environmental performance of business and/or industrial sector through engagement in environmental improvement activities and mandatory compliance with environmental standards. Participants to the PEPP are either of two tracks. Track 1 includes businesses that have superior environmental performance while Track 2 covers

businesses that are not yet in full compliance with environmental laws but are aiming for improved environmental performance.

For track 1, the government provides businesses several incentives such as public recognition and regulatory assistance, financial and fiscal incentives, and technical and/or technology information assistance on appropriate pollution/cleaner technology from the DENR and DOST and other concerned institutions. For track 2, the government shall enter into an agreement with concerned businesses through the use of Environmental Consent Agreement (ECONA). The ECONA binds the company to comply with the environmental rules and regulations stipulated in its EMS within eighteen (18) months of entering into the said agreement.

Companies covered under either track should submit an Environmental Management Plan to serve as proof of their commitment to manage their significant aspects and impacts, including compliance to environmental rules and regulation. The Plan will become the basis for evaluating the progress or level of accomplishment of companies with respect to its environmental management and performance. The Plan shall include the company's environmental programs, objective and targets, resources, and procedures necessary to attain the objectives, targets, and programs. Participating companies shall submit regularly environmental reports to the Environmental Management Bureau of DENR. The report shall contain the measures taken by the companies in order to fulfill all relevant environmental requirements as well as the results.

Through the PEPP, environmental regulation and monitoring responsibilities are transferred from the government to the company, with the help of third party environmental auditors in their audit of the environmental report submitted by the participating companies. The program provides a process similar to a big manufacturer monitoring the operations of its suppliers on a regular basis and assisting them to comply with the environmental standards. Although, the PEPP promotes the implementation of various environmental regulations in the country without the need for large expenditures in policing and controlling activities of the government, it may result in thin participation of the industries. Local contractors, especially the small ones, may still find it financially burdensome to invest in equipment required to improve their environmental performance.

8. CONCLUSIONS AND RECOMMENDATIONS

The report identified environmental and health requirements in the US, European Union, Japan, and Singapore. These requirements include regulatory and market-led pressures for environmental probity in the electronics sector. The report then identified and analyzed the mechanisms in the Philippines for obtaining such information on environmental and health requirements in key export markets. It went on to understand the adjustment process being taken by electronics industry in response to these requirements. It aims to shed light on the effects of environmental and health standards on the competitiveness of the electronics industry. Through this analysis, the report aims to formulate appropriate local strategies for

addressing policy developments in environmental and health protection in the industrialized countries.

Three trends are worth noting from the analysis presented in the previous sections. *First*, there is movement towards integrated environmental management, which addresses the environmental impacts of the total product life cycle. *Second*, while production of electronic products is fragmented and dispersed, it remains an integrated system that finally produces the complete electronics product. *Third*, the electronics industry in the Philippines strongly competes with other exporters win a share of the export market of the US.

Environmental and health policies in industrialized countries are increasingly being executed through market forces. These include eco-labels, requirements set by importers, financial incentives and disincentives, and certification of environmental management systems. The new policies are now emphasizing the environmental impacts of products in the total product life cycle, including the extraction of raw materials, the production of semi-manufactures, the assembly of the final products, and the disposal of the product at the end of its useful life.

The electronics industry has been one of the dynamic sectors in the global economy. Reliance on electronics goods fuelled the growth of the global electronics industry, allowing it to dominate the market in developed countries as well as developing countries. Electronics industry moved from developed to developing countries in response to the high labor yet low cost requirements of the industry. As a result, multinational companies established their own subsidiaries in developing countries. This expansion seemed inadequate with respect to the rising demand for electronics products, contributing to the rise of contract manufacturers to produce the gaps not met by the subsidiaries. While the capital-intensive production processes such as wafer design and fabrication, occur in developed countries, assembly and product testing, being the labor-intensive portion of the production processes, take place mostly in developing countries. Thus, we see that production of electronics products occurs in different organizations that are located in different countries. Although production is fragmented and dispersed, it remains an integrated system that finally produces the final electronic product.

The electronics industry in the Philippines, in particular the semiconductor industry, is export-oriented; the industry's welfare is very dependent on the state of the world market for semiconductors. The US buys almost a third of the semiconductors produced in the Philippines, but exports to other international markets are slowly catching up. Any movement, therefore, in the US economy will strongly influence the industry's performance. In addition to the Philippines, many other countries are also exporting semiconductor to the US. These other countries represent a threat to the semiconductor industry in the Philippines in terms of attracting investment from multinational companies. Malaysia, which is the world's third largest producer and exporter of semiconductors, offers the lowest operating costs among the members of the ASEAN. Vietnam has the most liberal investment environment, but the cost of doing business is high because infrastructure and support facilities are not adequate. Thailand and Indonesia offer lower energy and labor costs than other ASEAN countries.

As pressures to produce green electronic products mount, there is also increasing realization of the need to develop a systematic, integrated approach to environmental management if companies are to achieve environmentally satisfactory operations. Business now has the role that is moving towards product stewardship and extended product responsibility. Hence, electronics companies must take care of the total life cycle environmental impacts of its products. They have to meet these requirements: (1) product standards established because of health, safety or environmental reasons; (2) that process requirements regarding emissions at the production site; and (3) the disposal requirements.

Considering the structure of the global electronics industry, a holistic approach of environmental management by electronics companies in the industrialized countries must ensure that components supplied by their subsidiaries and contract manufacturers also meet all environmental and performance standards. Like all industry, the electronics industry has realized that the quality and cost of their products depend on their suppliers throughout the world. Similarly, there is also increasing realization that the environmental performance of electronics companies depends on the environmental performance of their suppliers throughout the world (USAEP, 1999). Hence, parent companies can exert the greater push for adopting environmentally sound production in companies from the developing countries. In fact, many of these companies monitor the environmental performance of their suppliers, almost taking the place of government regulatory agencies. A more proactive approach is for mother companies to assist their suppliers in meeting global environmental standards.

Environmental policy development is increasing the weight of environmental factors when electronics companies decide on where to locate investment in the developing countries. Although not a very strong deciding factor as yet, waste management infrastructure of a country may eventually influence the decision of parent companies to bring production in a developing country. Hence, semiconductor investments will go to countries where waste management capability is high. The assumption here is that the cost of disposing hazardous materials is becoming more prohibitive. Availability of waste management infrastructure could offset such cost. The lesson for the Philippines is to go for a stern enforcement of environmental legislation while it upgrades its waste management facilities and capabilities to world-class standards in order to ease the financial burden of treating hazardous wastes, especially that of small contractors. Countries with more advanced waste management facilities may attract more investments than countries with no capability of treating hazardous wastes.

More and more companies are now requiring ISO 14001certification to assess capability of a contractor or supplier in managing its environmental aspects and impacts. Since this is becoming an international market-based requirement, the country should facilitate ISO 14001 certification. The government should provide appropriate incentives to facilitate the process of developing environmental management system and enhance ability of companies to certify their EMS to the ISO standards.

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Appendix 1. Classification of the Philippine Electronics Industry

Sector	Sample Products	Major Players
Components and Devices (Semiconductor)	Pentium III, DSPs, Integrated Circuits, Transistors, Diodes, Resistors, Coils, Capacitors, Transformers, Lead Frames, Printed Circuit Boards	Subsidiaries of Intel, Texas Instruments, Philips, Amkor, and Fairchild Semiconductors
Electronic Data Processing	Personal Computers, Hard Disk Drives, Floppy and Zip drives, CD-ROM, Motherboards, Software development, Data Encoding and Conversion, Systems Integration Customization	Toshiba, Acer, Epson, Fujitsu, Ionics, and Sampo Technology
Consumer Electronics	TV sets, VCD players, Electronic Games, Radio Cassette Players, Karaoke Machines, Radio Cassette, Recorder	Matsushita Electric (Panasonic), Sony, Sharp, LG-Collins, and JVC
Telecommunications	Telephone, Modems, copper communication cables, fiber optic cables, VHF and UHF Radios, Cellular Phones, Scanners, Satellite Receivers	ETSI Technologies, Eupen Cable, NEC Technologies
Office Equipment	Photocopy machines and parts, fax machines, electronic calculators	Matsushita Business Machines, Sharp, and Seiyo Electronics
Communications and Radar	Cellular phones, Closed circuit television (CCTV), Radar detectors, marine and land mobile radios, CB transceivers	Matsushita Communication, Uniden, Casio, and Euro CB
Control and Instrumentation	PCB assembly for instrumentation equipment, testing equipment, digital thermometers, microscope, automotive test equipment	Precision Microcircuits, Sara Digital Network, Phil Makoto Corp, Insung Philippines Electronics
Medical and Industrial	Spiro analyzers, smoke detectors	P. Imes Corporation
Automotive Electronics	Electronic brake systems, car body electronics, car stereos, wiring harness	Temic Automotive, Fujitsu Ten Muramoto Audio-visuals Philippines, Clarion Manufacturing

Appendix 2. Overview of main health hazards in the electronics industry

Hazard	Process	Acute Effect	Chronic Effect
Acids	Electroplating Etching Crystal polishing	Skin burns Eye irritation	Lung disease Bone damage Erosion of teeth
Metals	Electroplating Etching Soldering Tinning Sealing	Breathing problems Skin irritation Headaches Insomnia Stomach pain Miscarriage	Cancer Liver damage Sterilization Dermatitis
Gases	Doping Crystal growing Cap testing	Dizziness Nausea Vomiting Diarrhea Coma and death	Anemia Jaundice Liver damage
Resins (synthetics, epoxies, glues, fluxes)	Cutting Grinding Encapsulation Laminating Packaging	Breathing problems Skin irritation	Cancer Liver damage Allergies Asthma
Solvents	Cleaning Degreasing Thinning	Skin irritation Cough Breathing problems Sore throat Dizziness Headache Nausea	Liver damage Kidney damage Heart damage Paralysis Cancer Allergies Menstrual disorders