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CHAPTER 2: Environmental requirements and market access for developing countries: the case of electrical and electronic equipment

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Chapter 2

Environmental Requirements and Market Access for Developing Countries: The Case of Electrical and Electronic Equipment

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A. Introduction

Concern over growing volumes of post-consumer waste and associated environmental and health-related problems has triggered significant developments in environmental policies in many countries. Of particular relevance, both in developed countries and in several rapidly industrializing developing countries, is waste from electrical and electronic equipment (EEE). First, the volume of EEE waste is growing rapidly as a result of technological innovation (leading to products being replaced after a short period of time) and market expansion. Second, EEE waste may contain hazardous substances, such as heavy metals, that complicate recycling. Comprehensive new environmental legislation has been introduced in Japan and European countries with an increased emphasis on the prevention, reuse, recycling and recovery of EEE waste, including through the application of the principle of *producer responsibility*. Other countries, including some developing countries, have introduced regulations containing take-back obligations. In addition, a large number of initiatives by businesses and non-governmental organizations (NGOs) aim at promoting recycling, in particular of electronic waste. Company-specific efforts to meet corporate environmental goals and develop more environment-friendly products as part of strategic marketing initiatives are also a driver of change. Some industry initiatives have been taken with a view to strengthening competitive positions (one example being a voluntary agreement by the Japanese electronics industry to develop lead-free products ahead of the introduction of new legislation).[1]

As a result of new legislation in the European Union (EU) and Japan, businesses are expected to incorporate waste management considerations (such as the use of easily recyclable/recoverable materials, the control of hazardous substances, and the use, where feasible, of recycled materials and of common coding standards for components and materials) into the design and production of EEE. Since the production of EEE components has been increasingly outsourced to developing countries, in particular those in East and South-East Asia, such developments have significant implications for manufacturers and assemblers in these countries. They will need to find substitutes for heavy metals such as mercury, lead and cadmium, as well as respond to the requirements of importers and customers downstream in the supply chain, which would also involve design for recycling and associated material selection. Governments and companies in these countries need to promote proactive policies with regard to information gathering and management (including enhancing understanding of new requirements), and product engineering and design in order to compete successfully in international markets and, at the same time, address problems related to growing volumes of their own EEE waste.

This chapter reviews recent developments in regulatory and other policy instruments concerning EEE waste in major markets and their implications for producers in developing countries. It focuses on the EU, Japan and Switzerland because of their comprehensive legislation, which contains mandatory requirements, in particular the Waste Electrical and Electronic Equipment (WEEE) Directive and the Restriction of certain Hazardous Substances in electrical and electronic equipment (RoHS) Directive of the EU, the Home Appliances Recycling Law (HARL) of Japan, and the Ordinance on the Return, Take-back and Disposal of Electrical and Electronic Appliances (ORDEA) of Switzerland. The chapter pays particular attention to the experiences of China, the Philippines and Thailand, building on work carried out within the framework of the project, Building Capacity for Improved Policy-Making and Negotiation on Key Trade and Environment Issues, undertaken jointly by UNCTAD and the Foundation for International Environmental Law and Development (FIELD), and funded by the United Kingdom's Department for International Development (DFID). These three countries accounted for almost one third of the value of all EEE imports (excluding intra-EU trade) into major developed-country markets in 2003. The United States constitutes the largest market for EEE, including EEE from developing countries (see annex 2 for further details). The main focus is nevertheless on the EU, because of important recent developments in the area of environmental legislation in that market.

This chapter aims to draw lessons, based on the study of a specific sector – the EEE sector – which may help developing countries enhance their understanding of emerging environmental requirements

in international markets and strengthen their capacities to respond to such requirements, taking into account their own environmental and developmental conditions and needs. Key areas covered include:

- Salient environmental policy developments in key markets;
- Implications for exporting developing countries;
- Lessons that can be learned from national and regional (EU-level) stakeholder consultations in countries that introduce new environmental regulations, as well as consultations with third countries;
- Awareness and understanding of these new environmental requirements and adjustment approaches in concerned developing countries; and
- Strategies to address problems related to the growing volumes of waste from EEE in developing countries.

By addressing such issues, the chapter also aims to provide inputs to the work of UNCTAD's Consultative Task Force on Environmental Requirements and Market Access for Developing Countries (CTF), in particular with regard to:

- Communication and consultative processes with developing countries;
- Information gathering and dissemination by developing countries;
- Proactive adjustment policies in developing countries; and
- Capacity-building requirements and approaches.

This chapter is organized as follows: section B describes the developments in policies dealing with EEE waste in major developed-country markets. Section C examines possible implications of such policies for domestic industries as well as for international trade, in particular for exports from developing countries. Section D, seeks to draw possible lessons from experiences with stakeholder consultations during the process of designing and implementing legislation or other measures. Sections C and D are largely based on the EU experience, for which information and analyses are readily available. Section E describes the level of awareness and preparedness as well as the adjustment processes in China, the Philippines and Thailand. The conclusions and recommendations are contained in section F. Finally, annex 2 contains information on and an analysis of EEE waste and the Basel Convention.

B. Policy Developments Concerning Waste From EEE

EEE waste is growing faster than other waste streams. In the EU, for example, EEE waste has been growing three times faster than other municipal waste.[2] This fast growth is attributed to developments in technology, leading to products being replaced after a relatively short period of use,[3] and market expansion. Imports of used EEE and possible illegal trade in EEE waste have triggered the introduction of legislation (e.g. in China and Thailand) to regulate imports of second-hand equipment.

EEE waste may contain toxic and hazardous substances. For example, many electronic devices contain individual components made with hazardous substances, primarily heavy metals.[4] Cathode ray tubes found in colour television sets and colour computer monitors contain significant amounts of lead. Printed circuit boards found in computers and other electronic devices may contain lead and chromium. Some older computers contain mercury switches, and many kinds of electronic devices work on batteries containing nickel cadmium, nickel metal hydride, lithium or sealed lead acid (Colorado Department of Public Health and the Environment, 2003). The presence of such substances complicates the recycling and disposal of EEE waste from a technical, environmental and economic point of view.

Waste management policies have been put in place to address these concerns. These range from policies exclusively based on recycling to broader policies emphasizing the so-called 3Rs (reduce,[5] reuse, recycle) or 4Rs (which also refer explicitly to recovery of materials and/or energy).[6] The product coverage, choice of policy instruments and stringency of measures (including with regard to threshold levels and exemptions for hazardous substances) vary widely from coun-

try to country (and at times within the same country). The EU, Japan and Switzerland have introduced comprehensive legislative measures at the regional and national levels respectively. Other countries, in particular the United States, emphasize industry-led initiatives and have some guidelines for government procurement. In addition, in the United States and Canada a number of laws have been implemented or proposed at the local, state and/or provincial level. China and Thailand are implementing legislation to deal with their own problems related to waste from EEE, and are seeking to enhance the preparedness of industry to respond to the requirements of international markets.

Policies in several countries are, to different degrees, based on *producer responsibility.* The EU's WEEE Directive is based on *individual* responsibility, making producers accountable for the end-of-life management of their brand products.[7] Legislation in most other countries is based on *collective responsibility,* with producers sharing the costs of managing end-of-life products, regardless of the brand name, based on market shares. It is assumed that individual responsibility provides stronger incentives for clean product design as companies reap the benefits of lower recycling costs. Canada and the United States use the term *product stewardship.*

Government regulations aimed at phasing out hazardous substances are the most significant from a trade point of view. Product standards fall under the discipline of the WTO Agreement on Technical Barriers to Trade (TBT) and its notification provisions. The case of EEE clearly illustrates that product standards to address local environmental concerns in major markets can have significant implications for process and production methods in other countries. Finding substitutes and making the adjustments needed to manufacture components that work with such substitutes often require large investments of time, financial resources and technical skills. Because of globalization of international trade and investment flows, standards in major markets have a significant impact on standards and regulations in other countries.[8] Moreover, requirements imposed principally through the supply chain may have important implications for companies in developing countries, particularly small and medium-sized enterprises (SMEs).

Emerging requirements in the EEE sector also illustrate the importance of product design. It has been argued that over 80 per cent of the costs of complying with environmental requirements tend to occur at the design stage.[9]

An analysis in the EU context seems to indicate that there are relatively extensive and reasonably transparent processes of multi-stakeholder consultations on environmental policies at both the Community and member State levels. However, trade implications seem to receive little attention either in these processes or in regulatory impact assessments.[10] Whereas major trading partners have provided comments on new regulations from the early stages of their development, developing countries with a key export interest in EEE, and often providing a significant share of the total EEE supply, have not participated to the same extent. In fact, the values of EEE imports from developing countries into major developed-country markets are several times higher than those of imports from other developed countries (excluding intra-EU). For example, the value of EU imports of EEE from developing countries in 2003 was $98 billion, twice as high as those from developed countries ($49 billon). In Japan, nearly 80 per cent of EEE imports by value originated in developing countries (annex 2, table 3).

1. European Union: the WEEE and RoHS Directives

In 1996, the European Parliament adopted a Resolution asking the European Commission to present proposals for Directives on a number of priority waste streams, including EEE waste, and to base such proposals on the principle of producer responsibility. A key concern was to harmonize national approaches to EEE waste, as several EU member States had introduced national legislation.

The purpose of the WEEE Directive (2002/96/EC) is, as a first priority, the prevention of EEE waste, and, in addition, the reuse, recycling and other forms of recovery of such wastes so as to

reduce the amount disposed of.[11] The Directive also seeks to improve the environmental performance of all economic operators involved in the life cycle of EEE and, in particular, operators directly involved in the treatment of EEE waste. It requires the EU-25 member States to set up collection and financing systems for EEE waste by August 2005 and to meet collection and recovery targets by December 2006 (see annex 1 below). The RoHS Directive 2002/95/EC, on the other hand, aims to eliminate hazardous materials from waste streams by prescribing that, as of 1 July 2006, new EEE put on the market may not contain lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers (PBDE),[12] with certain exceptions.[13]

The Commission had originally started to prepare a single Directive. However, the complexity of the issues and controversy over whether to strive for minimum standards (EEE waste management) or harmonization (for hazardous substances) prompted it in 2000 to develop two directives:

The WEEE Directive is an "environmental Directive" (with a legal basis in Article 175 of the Treaty establishing the European Community), which allows member States to use the principle of *subsidiarity* in transposition into national law. This gives member States a degree of discretion in establishing national systems to implement the Directive as long as they ensure that its objectives are achieved. Basically, it means that there will be different WEEE regimes, with the EU setting minimum standards and some countries setting higher targets (e.g. for recycling rates).

The RoHS Directive is a "single-market directive" (with a legal basis in Article 95 of the Treaty establishing the European Community) aimed at providing a "level playing field" by setting the same standards across all member States.

The WEEE Directive applies to 10 categories of EEE (see annex 1). From a trade point of view, IT and telecommunications is by far the most important category, representing an import value of $112.8 billion (excluding intra–EU trade) in 2003, of which $68.4 billion originated in developing countries ($58.5 billion in East and South-East Asia[14]) (annex 2, table 2).

At the time of writing, many issues were still to be decided upon or open to interpretation.[15] Some of these may be left for member States to decide in the process of transposition into national legislation, in particular in the case of the WEEE Directive. A Technical Adaptation Committee (TAC), comprised of member State officials and chaired by the Directorate General, Environment, is in charge of the amendments needed in order to adapt the Annex to the Directive to scientific and technical progress. These amendments include fixing of maximum concentration values, exemption of certain materials for which substitution is technically or scientifically impracticable, and a review of each exemption every four years.

The two Directives were to be transposed into national legislation by 13 August 2004. However, only Greece met this deadline (European Commission, 2004). By March 2005, Austria, Belgium (partially), the Czech Republic, Cyprus, Estonia, Finland, Latvia, Lithuania, Luxembourg, Hungary, the Netherlands, Portugal, Slovenia, Slovakia and Spain had also implemented national measures transposing the WEEE Directive.

Producer responsibility

The WEEE Directive is based on the principle of *producer responsibility*. In the case of individual responsibility, this is one of the means of encouraging the design and production of EEE in a manner that facilitates its repair, possible upgrading, reuse, disassembly and recycling. Producer responsibility began to be applied at the EU level with the implementation of the 1994 Packaging Directive (Enhesa-Environmental Policy Centre, 2003). Measures adopted in 2000 with respect to end-of-life vehicles further expanded the regime of producer responsibility.

Box 1. Existing or proposed EU legislation establishing producer responsibility

The Packaging and Packaging Waste Directive (94/62/EC) aims to harmonize national measures in order to prevent or reduce the impact of packaging and packaging waste on the environment and to ensure the functioning of the internal market.[a] It contains provisions on the prevention, reuse, recovery and recycling of packaging waste. Several member States use producer responsibility regulations to implement this Directive. The amendment to the Directive (Directive 2004/12/EC, February 2004) includes more stringent targets for recovery and recycling.

The End-of-Life Vehicles (ELV) Directive (2000/53/EC) came into force on 21 October 2000. The Directive includes: (a) new regulatory controls on the treatment (scrapping) of ELVs; (b) an obligation for producers (manufacturers and importers) to pay "all or a significant part" of the costs of take-back and treatment of ELVs from January 2007; (c) reuse, recycling and recovery targets; and (d) reduction of the amount of hazardous material in vehicles (including a restriction on the use of heavy metals in new vehicles from July 2003).

Batteries Directive. On 24 November 2003, the European Commission adopted a proposal for a new Directive on batteries and accumulators and spent batteries and accumulators (COM (2003)723final). Producers must arrange financing for the collection, treatment, recycling and sound disposal of all types of collected spent batteries. The cost of collecting portable batteries may be shared among producers and national, regional and local authorities. The proposed directive would apply to all types of batteries regardless of their chemical composition.[b]

Eco-design of Energy-using Products (EuP) Directive.[c] The European Commission has been developing framework legislation that would define the general policy and principles to be followed in developing specific implementing measures relating to eco-design in energy-using products. The stated objectives are: (a) ensuring the free movement of energy-using products within the EU; (b) improving the overall environmental performance of these products (e.g. in terms of energy consumption and related contributions to climate change, consumption of materials and natural resources, waste generation and release of hazardous substances); (c) contributing to the security of the energy supply and enhancing the competitiveness of the EU economy; and (d) preserving the interests of both producers and consumers. The European Parliament and the Council adopted a final text in July 2005.[d]

An important driver behind the EuP Directive is the commitment of the EU to the Kyoto Protocol targets for reducing greenhouse gas emissions by 2012. According to some, in terms of its potential impact, this is one of the most significant environmental directives proposed by the Commission. As a framework directive, it sets the context, scope and legal framework for achieving the above-mentioned objectives but does not in itself impose obligations or requirements directly on manufacturers - only on member States. It is the implementing measures that will establish eco-design requirements for particular aspects and products. The Framework Directive was, in principle, intended to apply to any product that uses energy. However, the Commission stated that it did not intend to produce a large number of implementing measures. Product coverage and conformity assessment procedures nevertheless remain among the open questions.

[a] http://www.europa.eu.int/comm/environment/waste/packaging_index.htm.

[b] The previous battery directives only applied to an estimated 7 per cent of all portable batteries placed on the EU market annually with certain mercury, lead and cadmium content. According to DTI, the legislation failed to provide a framework for battery collection and recycling (http://www.dti.gov.uk/sustainability/ep/batteries.htm#Current_legislation).

[c] http://europa.eu.int/comm/enterprise/eco_design/.

[d] Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a frame.

2. Japan

In July 1999, the Industrial Structure Council predicted severe pressures on landfill and recommended working towards the vision of a recycling-oriented economy. Japanese industry has been active in developing lead-free products (e.g. through a voluntary agreement). Although lead-free initiatives started long before any industry regulation was introduced, in 1998 the electronics assembly industry began to aggressively pursue the removal of lead from the manufacturing proc-

ess. The Japanese Electronic Industry and Technology Association (JEITA) has been working to eradicate lead from EEE. It has played a lead role in the development, jointly with representative organizations of the United States and Europe, of the Roadmap for Commercialization of Lead-Free Solder. According to the most recent version of the Roadmap, companies in the electronics industry should stop using lead soldering materials by 2005.

Since 2000, various laws relating to waste management and recycling have been enacted or amended (Charter, et al., 2002). These fall into four main categories:

- *Basic framework laws*. These include the *Fundamental Law for the Creation of a Sound Material-Cycle Society*, approved in 2000;
- *Laws for proper waste management and recycling*. This includes the *Law for the Promotion and Effective Utilization of Resources* (LPEUR), which promotes the 3Rs (reduce, reuse, recycle). In accordance with LPEUR, 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 3R measures, including through eco-design.[16] Companies have to submit their planning report to the Ministry of Economy, Trade and Industry (METI) for approval. In March 2001, the law's coverage was increased to 10 sectors and 69 products. LPEUR effectively makes eco-design obligatory for electronic products. It imposes an obligation on manufacturers and importers to collect and recycle resources. New legislation concerning recycling of personal computers (PCs) became effective in October 2003; it makes PC computer manufacturers liable for their collection and recycling;[17]
- *Laws for promoting specific waste recycling*. Effective as of 1 April 2001, the *Home Appliances Recycling Law* (HARL) requires the manufacturers and importers of air conditioners, televisions, electric refrigerators and electric washing machines to take back the end-of-life equipment and recycle it. Freezers were added in April 2004. The scope of HARL is smaller than that of the EU's WEEE and RoHS Directives. It has been estimated that HARL accounts for 80 per cent of EEE waste in Japan (Toshihiko Fujii, 2002). The Law also promotes research, development and testing of recycling technologies and the manufacture of products using recycled materials; and
- *A law for promoting greater utilization of recycled materials*. The *Green Purchasing Law* requires government bodies to take a lead in procuring "environment-friendly" products and materials.[18] In addition to government regulations, many companies have established green procurement guidelines and have disseminated those to suppliers. Some have also have formed alliances with suppliers in other countries. This effectively has created a green market for many products procured by the public sector, which has stimulated industry to produce environment-friendly products ahead of competitors in Europe and the United States.

Producer responsibility

Japanese EEE waste regulations incorporate the principle of producer responsibility.[19] HARL specifies that manufacturers have obligation to collect their own products. However, with regard to financing, HARL relies on end-of-life recycling and collection fees paid by consumers. In practice these fees cover only part of the costs and manufacturers have to pay the rest (INFORM, 2003).

3. United States

In the United States, federal initiatives to address EEE waste problems include, for example, voluntary programmes, multi-stakeholder initiatives and green purchasing.[20] There is no federal EEE waste legislation. However, an increasing number of state and local governments are implementing legislation for managing end-of-life electronic equipment.[21] In some cases, the product coverage is limited to hazardous EEE, but the restrictions on the use of hazardous substances can be as stringent as in the EU's RoHS (e.g. in California). An additional, trade-related concern is the export of EEE waste to developing countries, in particular to those of South-East Asia.

In the state of California, the *Electronic Waste Recycling Act of 2003* (SB 20)[22] inter alia establishes a funding system for the collection and recycling of hazardous electronic wastes.[23] The California Department of Toxic Substances Control (DTSC) is to adopt regulations (similar to the EU RoHS) establishing deadlines and procedures for the phase-out of hazardous materials used in the manufacture of devices sold in California no later than 1 January 2007. The California Integrated Waste Management Board must annually establish, and update as necessary, state-wide recycling goals for the electronic waste covered by the Electronic Waste Recycling Act, but there are no goals for individual producers. Other states (e.g. Massachusetts, Washington and Maine) have introduced or passed similar waste-management and material-restriction legislation.

Trade considerations (i.e. the potentially adverse environmental and health effects of exports of used EEE, and possibly illegal shipments of EEE waste, to developing countries, particularly to those in South-East Asia) play a role in legislative measures and other initiatives in the United States. The California Act requires anyone who intends to export EEE waste covered by the Act to notify the DTSC and to demonstrate that the covered waste will be handled properly.[24]

The United States Environmental Protection Agency (EPA) manages a product-stewardship website[25] that provides information on developments concerning initiatives in the United States (and elsewhere). The National Electronics Product Stewardship Initiative (NEPSI),[26] for example, is a multi-stakeholder dialogue aimed at developing a national financing system to help maximize the reuse and recycling of used televisions and PCs. It includes representatives from electronics manufacturers, retailers, state and local governments, recyclers, environmental groups and others. While agreement has recently been reached on many principles to be incorporated into a national electronics management system, there are important issues, including details of the financing mechanism, which have yet to be finalized (NEPSI, 2004). One example of a federal initiative is "Energy Star", a voluntary partnership between EPA, the Department of Energy, manufacturers, local utilities and retailers.[27] Partners promote energy- efficient products by labelling them with the Energy Star logo and educating consumers about the benefits of energy efficiency. There are also a large number of industry initiatives.[28]

4. Canada

In Canada, EEE waste policies focus on product stewardship. The federal Government, provinces, territories and the Canadian electronics industry are working together to support the development of product stewardship programmes for electronic waste across the country. The Canadian Council of Ministers of the Environment (CCME) has endorsed National Principles for Electronics Product Stewardship[29] to help encourage and facilitate the delivery of provincial and territorial programmes that are consistent nation-wide.[30] To ensure a level playing field for industry, a number of provinces have developed or are developing regulations requiring producers (or first importers) to take part in a stewardship programme for EEE waste.

In addition, 16 leading electronics manufacturers established a not-for-profit industry association, known as Electronics Product Stewardship Canada (EPS Canada),[31] to work with Canadian provincial governments and other stakeholders in support of efforts to harmonize approaches for managing electronic waste and to promote the concept of extended producer responsibility (EPR) for electronic products.[32] Initially, EPS Canada will focus on personal computers, monitors, televisions, laptop computers and printers. Additional electronic materials will be added as the programme develops.

A general view is that recycling legislation should be the responsibility of the provinces and territories, and not that of the federal Government. Certain provinces have developed or are developing legislation concerning the collection and management of WEEE.[33] For example, the province of Alberta adopted the first provincial recycling legislation in Canada.[34]

5. Switzerland

In Switzerland, national legislation has been in force since 1 July 1998. The *Ordinance on the Return, Take-back and Disposal of Electrical and Electronic Appliances* (ORDEA) covers household appliances, consumer electronics, office, IT and communications equipment, and other components of EEE waste. Manufacturers or importers have to take back appliances of their own brand or of the brand they sell. Retailers must take back all appliances[35] similar to those they sell.[36] ORDEA has achieved good results: collected WEEE in Switzerland was 8.5 kilograms per capita in 2002. More than 75 per cent of end-of-life equipment is recycled, approximately 20 per cent is incinerated, and three per cent ends up in landfills.[37]

In addition, two voluntary schemes have been introduced: the Swiss Association for Information, Communications and Organisational Technology (SWICO),[38] which has been dealing with "office equipment" and consumer electronics since 1994, and the Foundation for Disposal in Switzerland (S.EN.S),[39] set up in 1991, which deals with waste refrigerators and freezers, washing machines, dryers, dishwashers, ovens, stoves, electric heaters and small household appliances. Also, manufacturers have established a Convention for Recycling and Disposal that obliges participants to impose an advanced recycling fee on the sale of new equipment. Manufacturers transfer their fee to a recycling account held by SWICO or S.EN.S. The fee covers about two thirds of recycling costs, and sales proceeds from recovered secondary materials cover the rest.

C. Implications

Potential environmental benefits of the policies described in section B include: reduced amounts of waste sent to landfill, improvements in air and water quality, and improved resource productivity. The main benefits from restrictions on the use of hazardous substances (e.g. through RoHS) should derive from reduced harm to human health and the environment (in terms of risks to biodiversity and animal life). In the case of developing countries, benefits may be significant where the levels of concentration of hazardous substances are relatively high, and control of landfills and recycling activities weak or not well enforced. The policies analysed in section B also imply costs to governments and the private sector. This section focuses on the implications of EU legislation for producers. This example has been chosen because of the lead role the EU has been playing in introducing mandatory requirements and owing to easy access to information about the EU legislation.

1. Implications for producers

The United Kingdom's Departments of Trade and Industry (DTI), and Environment, Food and Rural Affairs (DEFRA) (2003) tried to assess the costs and benefits of the two Directives for the country. The total costs to British companies were estimated at:

- £120 million (approximately $216 million[40]) per annum, annualized over 10 years for capital costs and research and development (R&D) costs, to comply with RoHS;
- £55–£96 million (approximately $99–$173 million) per annum for increased operating costs from using alternative substances, to comply with RoHS post-2006; and
- £217–£455 (approximately $391–$819 million) per annum to comply with the WEEE Directive.[41]

Of particular interest are lessons that can be learned from DTI's partial regulatory impact assessments, especially with regard to the methodologies used. In the case of RoHS, DTI expects that the business sectors that could be affected either directly or indirectly will include component suppliers, product assemblers and manufacturers (DTI, 2003).[42] In the domestic or EU context, it believes that component suppliers are likely to bear most of the costs in the short term, but that in the long term they are likely to pass on these additional costs to the assemblers and/or manufacturers. The magnitude of this will depend on the relevant market structure.[43] DTI notes that the

majority of components used in the United Kingdom are imported, and thus the final impact on the country's industry will derive generally from the proportion of the additional costs that are passed on to the final assemblers/manufacturers in the United Kingdom.

The Department recognizes that it is difficult to quantify the precise costs of the Directive, given its complexity and the scope of its impact. In particular, there is currently little information about the costs of substituting controlled substances. In order to comply with the RoHS Directive, manufacturers will have to sustain costs of redesigning manufacturing machinery, general R&D costs to find and test alternative substances, and, at least in the short or medium term, higher operating costs. DTI estimates that annual operating costs will be higher in general than those incurred in using the banned substances for the following reasons:[44]

- Increased costs of substances and components: substitutes of lead, cadmium, and in some cases brominated flame retardants, are generally more expensive;
- Increased costs of energy (alternative processes may require more energy to perform the same procedure): lead-free soldering, chromium passivation and brominated flame retardants use more energy;
- The need to use a greater quantity of material (alternative processes need more material to achieve the same results), particularly for hexavalent chromium and cadmium; and
- Reduction in throughput on soldering machines and increase in waste from lead-free soldering machines.

DTI recognizes that RoHS could disproportionably affect SMEs that may not have the financial resources to undertake R&D to develop substitutes. If the time to redesign components is limited, component manufacturers may concentrate on redesigning those components that go into high volume products. This may affect the supply of components to smaller companies that specialize in products with low sales volumes. During the negotiations on the WEEE Directive, the Government of the United Kingdom attempted, unsuccessfully, to gain a five-year exemption from its requirements for SMEs.[45] On the other hand, some argue that SMEs may actually move faster in making adjustment than large companies due to their size and decision-making structure.

2. Implications for companies in third countries

Companies in the EEE sector may have to (a) meet their own legal obligations (in certain cases, see below) under the WEEE and RoHS Directives with regard to the products they place on the market of any EU member State, and/or (b) assure customers downstream in the industry that their inputs do not compromise the obligations of those customers vis-à-vis the Directives. For companies in developing countries, the legal obligations inherent in the WEEE and RoHs Directives are manifested in requirements imposed through the supply chain. For example, suppliers are being asked to certify that their products do not contain restricted substances and to provide information on the composition of their components.

In accordance with the definition of "producer" in Article 3 of both the WEEE and RoHS Directives, the manufacturer or the importer is legally responsible for compliance with the Directives.[46] It should be noted, however, that suppliers or manufacturers of individual components, sub-assemblies or consumables are not considered "producers" for the purposes of the Directives. Considering that authorities would normally hold only one "producer" responsible, in the case of EEE exported from non-EU countries to the EU as a final product, it would appear that:

- Where the manufacturer sells the EEE in the EU under its own brand it would be legally responsible for compliance with the Directives;[47]
- Where the EEE is exported to the EU under the brand of another company established in the EU, that other company is legally responsible.[48] Developing-country companies often sell under the brand names of EU companies, and are thus not directly responsible for legal compliance;[49] and
- Where the manufacturer is not established in the EU and has no authorized representative there, the EU importer is responsible for compliance with the Directives.

EU importers that are responsible for compliance of a product imported from a third (non-EU) country need to ensure that exporters provide certain information. Under the WEEE Directive this concerns, in particular, information to be provided under Articles 10 (information for users), and that on reuse and treatment for each type of new EEE put on the market under Article 11 (information for treatment facilities). For example, EU customers have reportedly already been asking producers in Thailand to provide such information. The importer will also need information from the supplier concerning hazardous substances to ensure compliance of the final product with RoHS. It is still not entirely clear how compliance will be enforced. This seems to be an issue of major concern in South-East Asia. Eventually this will depend on the implementation of the Directives at national level. Harmonization of compliance will be important from a single-market as well as a trade point of view.

Box 2. Supplier requirements

Many customers in the EEE sector are demanding information from suppliers in order to have a greater degree of assurance that products are in compliance with RoHS (see also box 7). Typically, this may be through supplier material declarations, a document that discloses the part per million (ppm) levels of substances in a product. Such declarations are not required by legislation, and there is currently no industry standard that defines what a material disclosure should include. A variety of material declarations for suppliers are being developed by industry. Demands from customers vary in terms of scope, content, type and format of material disclosures. While some customers are requesting material declarations of only the six RoHS restricted substances, others are requiring disclosure beyond RoHS-banned substances.[a]

According to Motorola, in order to meet reporting requirements for original equipment manufacturers (OEM)[b] the entire supply chain must be engaged.[c] With a view to assuring compliance with legislation and managing risks, Motorola requires its suppliers to provide information on structure, materials and substances of concern for all production, services and parts, using a data collection tool called Compliance Connect™ (developed for the automobile industry). Suppliers need to consult the Motorola Controlled and Reportable Materials Disclosure Specification to determine how and what substances need to be reported, if they are contained in suppliers' components or products. Suppliers are also responsible for cascading the requirements in the Specification to sub-tier suppliers, as sub-tier supplier data are needed for a complete material and substance data determination.

[a] Tyco Electronics, TE Material Declaration Strategy, 20 September 2004 (see their website at: http://www.tycoelectronics.com/environment/pdf/te_rohscompliance_material_decl_position2007_20_2004.pdf).

[b] These are companies that build products or components used in products sold by another company. Originally, OEM was used to describe a company that produced hardware to be marketed under another company's brand.

[c] http://www.motorola.com/mot/doc/1/1502_MotDoc.pdf.

Of the two EU Directives, the RoHS Directive has the most significant effects on EEE manufacturers in developing countries. RoHS requirements potentially affect all manufacturers throughout the supply chain, including manufacturers of individual components. They will have to make sure that their components do not contain (or do not exceed the threshold values for) restricted hazardous substances and they in turn will have to require their suppliers of sub-components not to use them.

The need to find substitutes for restricted substances may pose difficulties for developing countries for several reasons:

- Lack of institutional and financial capacity in areas such as R&D and product design;
- Insufficient bargaining power to force large suppliers of commodities or other bulk inputs to develop substitutes;
- Difficulties in finding competent suppliers and in establishing cost-effective material- control programmes (see box 7);

- Uncertainty about the precise implementation of regulations concerning hazardous substances;
- Substitutes that are subject to intellectual property rights (IPR) protection may be expensive;[50]
- SMEs may face difficulties in providing product information; and
- Lack of capacity to influence decision-making in importing countries.

As mentioned earlier, there is concern that with increasingly stringent technical and product information requirements, many SMEs may be crowded out. To reduce the risk of non-compliance and the high costs incurred in demonstrating compliance, large companies may be inclined to harmonize and reduce the number of components and also the number of suppliers, in particular SMEs. To address this risk SMEs should seek to create alliances (Lutz-Günther Scheidt, Citraya Industries Ltd., personal communication).

D. Consultations

Consultations with stakeholders and trading partners with an export interest in the products that may be affected by standards and regulations is an important means of designing and implementing effective environmental policies while avoiding unnecessary adverse effects on trade.[51] In some cases, regulations themselves include mandatory provisions for stakeholder consultations. In the EU, for example, Article 5 of the RoHS Directive explicitly mentions that the Commission shall, *inter alia,* consult producers of EEE, recyclers, and environmental and consumer organizations before any amendments to the Annex (exemptions) can be made.[52] This section describes some experiences with regard to consultations, including efforts by the European Commission and some EU member States to promote bilateral consultations with key developing countries.

1. National or regional consultations

In the EU, the preparation of the WEEE and RoHS Directives has followed a process of EU-wide stakeholder consultations.[53] In addition, the process of transposition into national legislation has been subject to further consultations. For example, detailed information on stakeholder consultations and a partial regulatory impact assessment (RIA) of the United Kingdom's implementation of the WEEE and RoHS Directives are available on the DTI website. A consultation paper issued in July 2004 constituted the third and final phase of the United Kingdom Government's consultation process for implementation planning of these two Directives.

2. Consultations with third countries

From the early stages of developing the EU Directives, key trading partners, in particular Japan and the United States, as well as business associations, provided comments on the different drafts.[54] Common issues raised included the need to carry out appropriate risk assessments, the identification of hazardous substances to be exempted from RoHS and compliance costs (in particular with regard to historic waste before the amendment of Article 9 of the WEEE Directive). Bilateral consultations between United States and EU industries were held in 1999 under the auspices of the Transatlantic Economic Partnership Dialogue.[55] The biannual EU-Japan Regulatory Reform Dialogue in March 2003 was an opportunity for the Commission and member States to provide detailed information about the WEEE, RoHS and Registration, Evaluation and Authorisation of Chemicals (REACH) Directives, in response to Japanese requests.[56]

The American Chamber of Commerce to the EU (AmCham EU),[57] the American Electronics Association (AeA), the Electronic Industries Alliance (EIA), the National Electrical Manufacturers Association (NEMA) and the Semiconductor Industry Association (SIA) were also active in providing comments.[58] Similarly, the Japanese Business Council of Europe (JBCE) regularly gave detailed comments on the draft WEEE and RoHS Directives, including through position papers

and letters to the Technical Adaptation Committee and to governments of member States (concerning transposition into national law).[59] In addition, a number of Japanese and United States industry associations have contributed to recent stakeholder consultations on possible amendments to the Annex of the RoHS Directive.[60]

Developing countries, in general, have not been proactive, or have faced difficulties, in providing comments. China recently submitted a comment proposing amendments to the Annex to the RoHS Directive.[61] The EU and some member States have made efforts to assist developing countries in enhancing their understanding of the Directives.[62] For example, the Commission (Directorates General for Trade and for Environment) has organized bilateral meetings with China to present and explain the Directives. On 29 January 2004, the Delegation of the European Commission to Thailand and the Thai Industrial Standards Institute, with the support of the Federation of Thai Industries, organized a seminar on Waste Management Regulations: Implications to Electrical and Electronic Industries in Thailand. Other expert meetings have been planned for 2005 for experts from the EU and the Association of South-East Asian Nations (ASEAN) under the Trans-Regional EU-ASEAN Trade Initiative (TREATI). The United Kingdom has been active in trying to raise awareness of the impact of these two Directives in the areas of consumer electronics and IT manufacturing throughout the world. DTI officials have participated in a series of seminars, workshops and meetings with specific companies in China. Industry associations, including those outside the EU, such as the AeA, have also been assisting the Chinese Government and industry in complying with environmental requirements.[63]

Technical cooperation is also being provided. For example, the EU-Thailand Economic Cooperation Small Projects Facility (SPF), a three-year programme, was launched on 11 January 2005 with an EC contribution of 5 million euros.[64]

The draft EU Directives and some Japanese draft legislation were notified to the WTO in July 2000 (well before their publication in the *Official Journal of the European Communities*) [65] and discussed in the TBT Committee in 2001.

E. Adjustment in Processes in Selected Developing Countries.

This section reviews the experiences of China, the Philippines and Thailand in addressing emerging environmental requirements for EEE, based on work carried out within the framework of the UNCTAD/FIELD project, Building Capacity for Improved Policy-Making and Negotiation on Key Trade and Environment Issues (see also chapter 4 of this *TER*). In particular, it presents the main findings of country case studies[66] prepared under the project, analysing the interface between environmental requirements, market access/entry and export competitiveness in the EEE sector.

The main objectives of these country case studies were to examine the following: (a) the level of awareness among national producers, especially SMEs, of environmental and health requirements in key export markets; (b) the gathering, analysis and dissemination of information on environmental requirements; (c) current adjustment measures and proposals for proactive policies to effectively respond to new environmental requirements (in particular experiences with regard to national standards-setting, implementation of foreign standards and compliance assessment procedures); and (d) capacity-building needs.

1. China[67]

The share of technology-intensive products (primarily electronics) in China's total exports has increased dramatically, from 3 per cent in 1985 to 22 per cent in 2000 (in value terms), making China the largest exporter of such products in the developing world. In 2003, the value of EEE exported by China reached $160.9 billion: electronic equipment represented 57 per cent of its total

EEE exports (annex 2, table 1), while EEE represented 36.7 per cent of China's total exports in 2003. The largest share of China's EEE exports went to the United States (24.7 per cent), followed by the EU (21.7 per cent) and Japan (10.8 per cent) (annex 2, table 4).

China is implementing proactive adjustment policies to address domestic EEE waste problems as well as the challenges posed by new and more stringent environmental requirements in international markets. The Government is working towards developing an appropriate legislative framework. In addition, efforts are under way to improve the level of awareness on environmental and health issues, for example through the promotion of environmental management and certification.

In the past, apart from requirements in the area of waste management, EEE producers, in particular those with an export interest, have had to make adjustments to comply with mandatory environmental requirements such as obligations under the Montreal Protocol (for refrigerators), use of the EU/CE conformity mark[68] and the mandatory energy-efficiency labels for certain EEE in the EU. They have also become familiar with certain voluntary labels such as the United States-based Energy Star. Some steps taken to respond to these requirements include: information management, the introduction of the China Compulsory Certification ("3C") scheme, export permission to ensure that certain technical requirements are met, eco-labelling, certification of the International Organization for Standardization (ISO), clean production centres, and participation in the development of international standards. However, additional steps are needed to respond to external market requirements and to tackle domestic problems in the area of waste from EEE (Chamber of Commerce for Import and Export of Machinery and Electronic Products, China 2004).

Level of awareness of environmental and health issues

To assess the level of awareness among Chinese producers of environmental and health requirements in export markets, it is useful to make a distinction between (a) large manufacturers, (b) foreign-owned and export-oriented enterprises, and (c) SMEs. The level of awareness in large manufacturers is relatively high, although no formal channel for retrieving and analysing information has been developed. According to a study by Yang Changju (2004), several large manufacturers are now aware of the opportunities arising from preferences for more environment-friendly products, and are therefore making efforts to respond to both domestic and international environmental requirements. For example, Haier Co., China's leading manufacturer of electric household appliances, was one of the first enterprises in China to obtain ISO 14001 certification, and is interested in competing in green markets. The level of awareness in7 foreign-owned and export-oriented enterprises is also relatively high. For example, three out of four factories of Sony China Co. have obtained ISO 14001 certification, and Sony's Beijing Suohong Electronics Co. was the first communication terminals manufacturer to acquire this certification in China. Most foreign investment in the EE industry in China goes into export-oriented ventures. However, SMEs (which constitute the largest proportion of the current 11,700 EEE producers in China) know little about relevant environmental and health issues in key international markets.

There are various channels through which Chinese enterprises can obtain information on environmental and health requirements for EE products in international markets, including government departments and organizations, industry associations and information networks of the electronics industry, WTO enquiry points, and some university research centres. At the government level, there is no formal and coordinated mechanism for the collection and dissemination of information on environmental requirements for EEE in export markets. Some departments have been taking initiatives on an ad hoc basis. In February 2003 the Department of Science and Technological Development published a Chinese translation of the WEEE and RoHS Directives, and commissioned a study to assess the impact of the two Directives on EEE exports from China to the EU. Industry associations supplement government efforts concerning information management, but their services are usually available only to members. Moroever, these associations know little about environmental and health requirements in the key international markets, and the informa-

tion they publish is limited to short announcements about standards and legislation adopted by foreign governments. They also transmit through their networks the information published by government departments.

The TBT/SPS Enquiry Point of the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) and the TBT/SPS Consultation Centre of the Ministry of Commerce are the national official consultation and information collection centres that analyse and disseminate information on TBT and SPS measures. Besides the official channels, quite a number of TBT consultation centres have recently been established. However, some of these are not yet functioning effectively. There are also other networks that promote dissemination of information among Chinese enterprises, including a number of research institutions that conduct activities aimed at promoting an understanding of WTO disciplines and the capability to profit from them.

A number of early-warning mechanisms dealing with the environmental and health requirements imposed in key export markets have been set up, but they are still in their infancy and are not yet functioning effectively. Examples are the early warning system set up in 2003 by the Guangdong Quality Supervision Bureau and International Business and Economics Bureau in Guangzhou province, and another recently established by the local government in Wuxi City. The Ningbo Consultation Centre on Technical Barriers to Trade in the province of Zhejiang is also planning to establish a database on relevant technical regulations, standards (notified to the WTO) and other market-access conditions.

In February 2005, the AQSIQ, on behalf of the Chinese Government, related enterprises and industrial organizations, submitted a Chinese Stakeholder's response to the third EC Stakeholder consultation on a possible amendment to the annex of the RoHS. According to AQSIQ, hardly any enterprises had a clear idea on how to meet the requirements of RoHS, and some companies had little knowledge of that Directive.[69]

General adjustment approach

In order to supplement environmental legislation and stimulate market-driven environmental improvement, the Chinese Government has developed a national eco-labelling scheme. The programme is managed by the Chinese Certification Committee for Environmental Labelling (CCEL), which was established by the State Environmental Protection Administration (SEPA) in 1994. To date the programme covers 46 product categories, including 11 electromechanical categories.[70] According to CCEL, in 2002 40 manufacturers of electromechanical products had obtained the environmental label. However, a number of enterprises failed to sustain compliance with the requirements, resulting in the suspension of their eco-label award.

China has also taken steps to improve domestic safety and quality standards. Effective August 2003, the China Compulsory Certification Mark (CCC Mark) is required for a wide range of manufactured products before they can be marketed, imported or sold in China. The CCC Mark is a compulsory quality and safety mark that replaces two previous compulsory inspection systems. It applies to products related to human, animal and plant life and health, environmental protection and national security. To date it is required for 19 product groups (formed from 132 product categories), including a number of electrical and electronic products.[71] In addition, China's Development Research Centre under the State Council is exploring a new energy policy strategy; it aims to increase energy efficiency through the adoption of new technologies and the provision of economic incentives for energy conservation and for the application of clean energy. In particular, standards have been developed for water-saving washing machines and energy-saving refrigerators. Another initiative is that of SEPA, which recently adopted Technical Policies for the Prevention and Control of Pollution of Waste Batteries to regulate the take-back and collection of waste batteries and establish a policy framework for their disposal and recycling.

Standardization in China is gradually changing, from being an exclusively government function to a cooperative process also involving non-governmental stakeholders, especially after China's accession to the WTO. With the expansion of exports and a growing number of external market requirements, the Chinese Government has become increasingly aware of the importance of active participation in international standards-setting. Both the Government and the enterprise sector are involved in this process. Indeed, in recent years, China has contributed to the development of a number of international standards.

In order to reduce the cost of compliance with technical barriers to trade and benefit from the opportunities arising from green consumerism, Chinese government departments are cooperating in a programme that aims at building technical capacity. To that end, they have formed a task force for overcoming problems related to standards and regulations. In 2003, in order to promote the export of electrical equipment, in accordance with the tenth five-year plan, the Ministry of International Economy and Trade and the General Administration of Quality Supervision, Inspection and Quarantine issued a note on creating favourable conditions for promoting the export of electrical and electronic products.[72]

Plans and legislation in the area of EEE waste

China has been developing legislation aimed at addressing the environmental implications of its rapidly expanding domestic production and imports of second-hand EEE, and at enhancing preparedness to respond to requirements for EEE in export markets. A SEPA draft white paper for the Policy on Technologies for the Prevention of Pollution Caused by Waste Electrical and Electronic Products proposed requiring producers of televisions, refrigerators, washing machines, air-conditioners, and computers to collect, recycle, and dispose of waste equipment in an environmentally friendly manner.[73] Shared responsibility would be allocated to producers, retailers and consumers for the take-back and safe disposal of electronic waste. Such a scheme would be financed by a special fund through the introduction of an environmental tax.

With a view to addressing problems related to the growing volumes of waste from EEE, the tenth five-year plan (2001-2005) on household electrical appliances (HEAs) aims to:

- Implement a recycling scheme for HEAs by the year 2005;
- Make the main components of HEAs recyclable; and
- Create a network of take-back and collection centres before 2020.

At present the following activities are being undertaken in China:

- Development of a work plan for creating a take-back and reuse system for waste HEAs;
- Creation of a recycling task force with representatives of the Ministry of Commerce, the Ministry of Finance, the State Administration of Taxation, the General Administration of Quality Supervision, Inspection and Quarantine, the Ministry of Science and Technology, the MII, the Ministry of Construction and SEPA;
- Drafting of administrative measures on recycling of waste HEAs and principles for the reuse of HEAs;
- Review of collection and recycling systems for HEAs in other countries; and
- Review and development of suitable HEA recycling technology adapted to Chinese conditions. This covers technical and economic aspects, including efficiency elements.

In 2003, the Chinese Government initiated major environment policy initiatives that affect the energy efficiency, hazardous material content, and end-of-life disposition of high-tech products, as well as the collection and recycling of spent batteries. In this context, China has been developing legislation that is similar in objectives, modalities and time frames to Japan's HARL on recycling regulations and the EU RoHS Directive on the elimination of hazardous substances (see below).

The Ministry of Information Industry (MII) has developed a draft regulation entitled Management Methods for the Prevention and Control of Pollution from Electronics Information Products. It separates the restricted substances component ("Chinese RoHS") from the recycling component, which has been transferred to the National Development and Reform Commission (NDRC). The NDRC has been given the responsibility to develop a recycling law similar to Japan's HARL, with the same product coverage (air conditioners, refrigerators, televisions and washing machines) but with the addition of computers. These categories have been chosen on the basis of the high volume and heavy weight of the products. The "Chinese RoHS" covers the same six chemicals as the EU Directive and has the same implementation date – 1 July 2006 (pushed back from 1 January 2006, as originally proposed). The legislation is being developed as a framework law for electronic information products, but at the time of writing the target sectors had not been announced. MII is working with industry to develop a catalogue of covered products for which to set "standards" for maximum tolerated thresholds of the banned substances. Among the products currently listed are: communication equipment, broadcasting/video equipment, computers, household electronic appliances and electronic components. In addition, China has introduced legislation to control imports of EEE waste and second-hand EEE.

Recommendations

Yang Changju's study highlights four priority areas to facilitate compliance with environmental requirements and promote Chinese electronics exports:

- Develop a joint programme between the relevant government institutions and industry associations that would activate the drivers for change (legislation and supply chain management) to move the industry from present levels of basic awareness on environmental management, product legislation and codes, to intermediate and advanced levels. In addition, it is recommended to move away from a reactive to a more proactive approach;
- Investigate the size and potential of the national recycling, reconditioning and reuse market for electrical and electronic products. In addition gain a detailed understanding of the business and environmental pros and cons of take-back models at the company level, and of producer responsibility legislation (or product stewardship) and collection models at the macro level. The relevant industry associations and government departments should participate jointly in this initiative;
- Implement a comprehensive eco-design training programme for product and industrial designers. This programme should focus on real business and environmental issues and opportunities resulting from products that have been developed and designed to take account of life cycle assessment. The tools used in such a programme should be practical, usable and cost-effective, bearing in mind the EuP Directive of the European Union; and
- Strengthen R&D in the environmental area (see also box 3).

2. The Philippines[74]

The electronics industry in the Philippines has seen spectacular growth since the early 1990s. EEE exports accounted for as much as 70 per cent of the Philippines' total export revenues in 2003 (annex 2 table 1),[75] up from about 25 per cent in 1990. The value of EEE exports amounted to $25.5 billion in 2003, with electronic equipment accounting for 97 per cent of total EEE exports (annex 2, tables 3 and 4). The electronics industry comprises about 800 electronics and related companies, 72 per cent of which are foreign-owned.[76] The number of workers – mostly operators, managers, technicians and engineers – employed in the industry was 250,000 in 1998, increasing to 335,000 in 2002.[77] There are two major segments: the finished electronic products sector and the electronic components sector. Companies in the finished electronic products sector consist of subsidiaries of TNCs and Filipino-owned SMEs. This sector produces goods that are mostly absorbed by the domestic market, and hence export revenues are small.

Much of the vitality of the electronics industry is due to the impressive performance of semiconductor manufacturing, which accounts for nearly all of the country's electronics exports and

Box 3. Other relevant recommendations

Strengthen environmental standards and requirements and establish environmental indicators for EEE.
China should gradually upgrade its environmental standards for EEE and improve the environmental performance/image of enterprises, especially SMEs. The country should draw lessons from its key export markets and put in place internationally accepted standards and regulations. In doing so, domestic environmental and developmental conditions, as well as institutional capacity and available environmental infrastructure should be taken into account.

Strengthen environmental management of enterprises to ensure their competitive advantages.
Strengthening environmental performance and environmental management is fundamental for enhancing the international competitiveness of Chinese EEE manufacturers. There is a need to promote ISO 14001 certification and to make Chinese eco-labelling programmes in the area of EEE consistent with those of key international markets as well as to promote mutual recognition.

Undertake technology innovation, expand FDI and actively develop domestic environment-friendly substitutes for hazardous or environment/health-affecting substances.
The development of domestic substitutes is of key importance for maintaining and expanding China's electronics exports in the long run. There is a need to strengthen R&D to produce environment-friendly substitutes. Financial support and investment incentives as well as strengthened cooperation with foreign institutions are essential. Special emphasis should be placed on encouraging transfer of technology and know-how relating to environment-friendly products and technologies through FDI, including joint ventures.

Establish a mechanism to monitor and disseminate relevant information, create an "early-warning system" for exporters, and strengthen international information exchange and cooperation on new and forthcoming environmental and health requirements in key export markets.
There is a need to strengthen TBT notification and enquiry organizations with a view to disseminating information and analysis on standards and regulations to Chinese exporters in a timely manner, through the Internet or other channels. Active participation in pre-standard-setting consultations should also be promoted. China should participate as much as possible in international coordination and negotiations aimed at harmonizing environmental standards and obtaining mutual recognition of conformity assessment methods on standards and eco-labelling schemes for EEE.

Source: Yang Changju (2004)

for more than half the value of its total exports. It involves mainly assembly and product testing, both labour-intensive activities that have been largely outsourced to developing countries.[78] There are two kinds of firms in semiconductor manufacturing in the Philippines: (a) contract manufacturers and (b) in-house manufacturers. Contract manufacturers are responsible for the assembly of integrated circuits used in the products of various end-user customers. They compete in the open market for orders for customer-designed circuits. Examples of large contract manufacturers include Amkor/ANAM and Hyundai of the Republic of South Korea and ASE (Advanced Semiconductor Engineering) of Taiwan Province of China. In-house manufacturers produce integrated circuits for use in the companies' own products, and include such firms as Intel, Motorola, Texas Instruments and National Semiconductor. Increasing demand for their products has led these in-house manufacturers to outsource assembly and product-testing tasks to contract manufacturers. While TNCs' subsidiaries are engaged in both in-house and contract manufacturing, Filipino-owned companies are mainly involved in subcontracted activities.

As the semiconductor industry in the Philippines has remained largely confined to assembly and product-testing activities, most of its inputs (about 95 per cent) are imported, mainly from the parent company. This is because the local companies do not have the technology to produce inputs that meet the industry's quality requirements. Only some imported inputs 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 indications that the country is now moving beyond simply assembling and testing. Several semiconductor companies have already set up R&D facilities, for example for computer-aided design and computer hardware design. Others are moving towards backward integration. For example, Intel Philippines has begun producing the Pentium microprocessor in the country, while Cypress Philippines and Gateway Electronics Corporation have included wafer back grinding in their domestic production.

Information management

In the case of TNCs' subsidiary companies, parent companies provide their Philippine subsidiaries with regular information on international environmental laws and standards and on how to respond to them. Subsidiary companies provide employees with seminars and training to familiarize the engineers and operators with new requirements. Many electronics companies are now increasing their efforts in supply chain environmental management (SCEM).

Filipino-owned electronics companies obtain information on local and external legislation from government agencies, industry groups and professional organizations. Companies that are members of business networks get 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 support to companies.

Industry associations, in particular the Semiconductor and Electronics Industries in the Philippines, Inc. (SEIPI), also play a key role in providing relevant information and in upgrading workers' skills. With 192 members, it is the leading organization of electronics companies in the country, and serves as the information centre for the country's semiconductor and electronics industry.

The Government monitors relevant information on new and forthcoming environmental and health requirements through its overseas offices. The trade officers of the Department of Trade and Industry report major issues, relevant data and concerns to the Bureau of International Trade Relations (BITR). After making a preliminary assessment of major concerns relating to new directives, the BITR relays the information to the relevant government agencies and industry organizations. It then requests industry to provide a written position on the new directives. To obtain additional feedback from the industry, the Board of Investment conducts various interagency consultations. The Bureau of Export Trade Promotions disseminates specific information affecting export industries.

Another means of retrieving information is through the Bureau of Product Standards (BPS), the country's national standardization body. BPS is a member of the International Organization for Standardization (ISO) and the International Electro-technical Commission (IEC), and participates in many of their technical committees. It is also active in regional standardization efforts, taking part in the activities of the Asia-Pacific Economic Cooperation (APEC) Sub-committee on Standards and Conformance and of the Pacific Area Standards Congress, a forum that strengthens and supports the international programmes of ISO and IEC. However, there appears to be no active participation of BPS in pre-standard-setting consultations. One reason is its lack of technical capability (e.g. testing laboratories and scientific equipment) to provide informed input on new standards.

Adjustment approach

As previously described, there are two types of firms operating in the electronics (mainly semiconducter) industry in the Philippines: (a) contract manufacturers and (b) in-house manufacturers (i.e. TNCs' subsidiaries). Pressures to meet environmental standards and the adjustment process to those requirements differ between these two categories of firms. In the case of TNCs' subsidiaries, adjustments depend largely on those adopted by the parent company; they tend to apply the same policies as the parent companies, and any change in the policies and production

processes of the parent companies, as a result of environmental legislation, will almost automatically also be applied by the subsidiaries. Parent companies provide the necessary training and technical and technological capacity.

The case of contract manufacturers, where suppliers and users do not belong to the same corporation, is different. The pressure on contract manufacturers to comply with environmental requirements in export markets comes from buyers. Producers of finished goods that need to comply with environmental requirements in domestic and export markets will expect their suppliers to meet the same requirements. Therefore contract manufacturers will be asked to make timely and adequate adjustments to allow downstream customers to comply with the new requirements. The majority of contract manufacturers in the Philippines, however, do not face major difficulties, because many of them use imported components and most of them are large companies with sufficient resources. They also tend to have close relationships with their buyers. In fact, several enterprises invest in training programmes to improve the environmental performance of their suppliers. Suppliers are regularly invited to consultations and meetings and receive continuous updates on new technologies.[79] The subsidiary of Texas Instruments in the Philippines, for example, closely monitors its suppliers and assists them in complying with new standards. In addition, SEIPI plays an important role in coordinating the adjustment process among all actors in the EEE industry.

Environmental legislation

The Philippines has introduced environmental legislation that is relevant for the EEE sector, even though no specific legislation has been developed or is being drafted to address EEE waste. The Department of Environment and Natural Resources (DENR), through its Environmental Management Bureau (EMB), is the agency in charge of implementing national environmental laws.

A number of Acts adopted by the Government and aimed at addressing environmental problems are relevant for the electrical and electronic industry. The Toxic Substances and Hazardous and Nuclear Wastes Control Act (No. 6969) of 1990 covers the importation, manufacture, processing, handling, storage, transportation, sale, distribution, use and disposal of all unregulated chemical substances and mixtures in the Philippines, including even those in transit. Several requirements and procedures must be met before undertaking any of the above activities: entities must register and secure a licence from the EMB; quarterly reports on the activities and transactions involving any of these substances have to be submitted to the EMB; containers should be corrosion-resistant and strong enough to withstand breakage during normal handling, transport and storage, and be properly labelled; and a management plan must be submitted to the EMB.

The Ecological Solid Waste Management Act (Republic Act No. 9003) aims to transform and improve the country's solid waste management through: source reduction and waste minimization measures, including composting, recycling, reuse and recovery before collection treatment and disposal in appropriate and environmentally sound solid waste management facilities. The Act empowers the local governments with responsibility primarily for the implementation and enforcement of their solid waste management systems. Local governments are required to: (a) establish city-level solid waste management boards; (b) develop and implement 10-year solid waste management plans; and (c) serve as members on the Metro Manila Board. The solid waste management plan focuses on source reduction through reuse, recycling and composting. The Act stipulates that local governments must divert 25 per cent of all solid waste through reuse, recycling and composting by 2006. They are also required to establish reclamation programmes and buy-back centres for recyclable and toxic materials. Collected toxic materials are sent to appropriate hazardous waste treatment and disposal facilities that meet the provisions of the Republic Act No. 6969.

Recycling and imports of used computers

In the Philippines, used EEE may be imported subject to compliance with quality and safety standards (Cagatan, 2005). These standards do not include criteria based on useful life, and no

attempts have been made so far to classify used EEE as either second-hand EEE or waste. Guidelines for the Importation of Recyclable Materials Containing Hazardous Substances have been issued through Department Administrative Order No. 28. These guidelines are based on the Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990. Imports of recyclable materials containing hazardous substances are allowed only with a permit from the DENR through the Environmental Management Bureau. The Import Commodity Clearance Certification Scheme is required to ensure that imported products comply with the Philippine National Standards. Most standards are set by the Bureau of Product Standards, while the National Telecommunications Commission is responsible for standard-setting and regulation of telecommunications equipment (new and second-hand). An NTC Task Force has been created to set standards for mobile phone imports, and it may also consider "useful life" criteria.

Other initiatives

The Philippines established an Eco-labelling Programme in March 2001, with the Bureau of Product Standards BPS-DTI and EMB-DENR serving as heads of the Programme.[80] With the aim of supporting industry self-regulation as an approach for improving the environmental performance of businesses, the Department of Environment and Natural Resources launched the Philippine Environmental Partnership Program (PEPP) in 2003. The programme specifically aims to establish and facilitate cooperation among environmental regulators and industry sectors in the formulation of a gradual approach to higher environmental standards. However, in practice, the level of participation of industries appears to be relatively low.

Recommendations

The considerable importance of the electronics industry in the Philippines requires a proactive approach to addressing domestic production-related environmental problems and the emerging requirements of international markets. With regard to the latter, Parayno (2004) concludes that the electronics and semiconductor industry in the Philippines faces a number of challenges, in particular with regard to information-sharing on environmental requirements, participation in pre-standard setting consultations, coordinated government efforts to assess implications of new environmental/health requirements, and the need to improve domestic infrastructure for waste management as well as the enforcement of environmental regulations.

The Philippines needs to improve its waste-management infrastructure and strengthen the enforcement of its environmental regulations with a view to continuing to attract FDI in the EEE sector and reducing costs to small-scale contractors. While environmental factors play a limited

Box 4. Required capacity-building efforts in the Philippines

- Comprehensive understanding of the environmental and health requirements in key export markets;
- Technical studies to analyse the implications of new environmental and health requirements;
- Improvement in information flow and dissemination;
- Enhancement of information sharing among relevant government agencies, the business community and NGOs;
- Involvement in pre-standards-setting consultations on new regulations that have significant implications for EEE exports of the country;
- Effective management of a take-back system for wastes from EEE following a study of systems used in developed and other developing countries;
- Effective hazardous waste management that meets international standards; and
- Ways to enhance the capabilities of SMEs to adopt environmental management systems (EMS).

role in investment location decisions, TNCs may find it more attractive to invest in countries that provide appropriate infrastructure for waste management, notably IT production waste.

3. Thailand

According to the Electrical and Electronics Institute (EEI) of Thailand, the value of Thailand's EEE exports (including parts) totalled $33 billion in 2004 (or more than 40 per cent of the total exports of the country), of which electronic equipment represented 59.3 per cent.

The main destinations of the country's EEE exports (using an adjusted definition, see annex 2) were the United States (17.6 per cent), the EU (16.3 per cent) and Japan (13.9 per cent). EEE exports to other countries, principally developing countries, accounted for 50 per cent (annex 2, table 4).

According to a recent EEI survey, 2,317 enterprises operate in the EE industry in Thailand, of which 1,898 are SMEs. Of these enterprises, 77 per cent are mainly parts suppliers and 23 per cent mainly assemblers. In foreign-owned enterprises and joint ventures the shares are 57 per cent assemblers and 40 per cent parts suppliers.

Thailand has taken several steps to adjust to external environmental requirements as well as to domestic challenges in the EEE sector. This section describes its proactive adjustment strategies. Some early initiatives include the establishment of a Subcommittee for Impact, Follow-up and Thailand Policy Determination to the EU Directives on WEEE and RoHS; the launch of a comprehensive study on environmental issues in the EEE sector (concerning, among others, legislation, economic impacts, life cycle analysis (LCA), eco-design and EEE waste management); a survey carried out by the National Metal and Materials Technology Centre (MTEC), which contributed significantly to the launch of the Thai RoHS Alliance (see below); a study tour (covering such aspects as recycling plants, EEE waste management, laboratories and RoHS reporting); a special meeting convened by the Prime Minister to address the need to update legislation, including to regulate imports of second-hand EEE. The establishment of the Office of Import Policy Administration was instrumental in the preparation of legislation to control imports of second-hand EEE. Thailand is now implementing a range of pilot projects and feasibility studies in the area of waste management (covering, for example, mobile phones, batteries, cathode ray tubes and fluorescent lamps), including improvement of its recycling infrastructure. An important ongoing initiative is the Green Productivity Movement Project (also known as "Green Camp") of the National Economic and Social Development Board (NESDB) and the EEI.[81]

Table 1. Structure of the electrical and electronics industry in Thailand

	Small	Medium	Large	Other	Total
Number of enterprises	1 576	322	240	179	2 317

	Total	Foreign and joint ventures	Local
Assemblers	533	303	230
Parts suppliers	1 784	714	1 070

Source: Electrical and Electronics Institute, Thailand

Assessing potential implications of environmental requirements

The level of awareness of environmental and health requirements among enterprises in the Thai EE industry varies according to the size of enterprises and the subsector in which they operate. When Thailand first analysed the specific requirements of the WEEE and RoHS Directives and their effects on its industry in 2002, their implications were not fully understood, especially concerning the RoHS Directive. Since then a number of research efforts and consultations have been initiated to assess the impacts of these Directives and discuss possible strategies to enable compliance with them.

The Ministry of Foreign Affairs of Thailand convened a number of meetings between Thai institutions and government departments, and submitted comments to EU officials during the stakeholder consultations via the representation of the European Commission in Thailand. The comments cover a number of recommendations on WEEE and RoHS Directives, including the following:

- The Directives pose special challenges to producers in developing countries, and an extended transition period would be required to achieve compliance;
- Developing countries have relatively low capacity as regards technology for developing the necessary substitutes for controlled substances and materials to comply with the requirements of the RoHS Directive, and would thus need assistance in terms of technology transfer and R&D;
- The broad coverage of EEE, irrespective of the recycling and reuse capabilities for each product, poses problems in terms of operational costs and management of their recycling and reuse. The Directives ought to have concentrated on those goods, such as large household appliances, that account for the largest volume of EEE waste; and
- The restrictions of the RoHS Directive should have been based on an appropriate risk assessment.

The Ministry of Industry set up a working group to keep track of the process and prepare action plans to cope with the WEEE and RoHS Directives, and domestic waste problems. Key areas of intervention identified included: (a) support for technology development and production process improvement, and (b) development and improvement of national legislation and standards.

The National Metal and Materials Technology Center (MTEC) carried out a research project aimed at assessing the EE industries in terms of their use of materials, substitution plans, and problems in switching to greener production. Activities carried out during the period February to August 2002 included an industry survey and a bill of materials assessment.[82] The results obtained from the survey were verified through factory visits to interview managers, study manufacturing processes, assess technical adjustment capability and observe company environmental practices. Since only a few companies were aware of the WEEE and RoHS Directives and understood their impacts, MTEC organized two seminars on eco-materials to provide industries with basic information, technical considerations and guidelines to prepare for the adjustment. The project resulted in a set of recommendations to the Government to prepare the country for the emerging environment-related legislation.

Further MTEC surveys were conducted during two eco-materials seminars and workshops organized by MTEC in 2004. Of the 145 companies that responded, 74 per cent said that the RoHS Directive affected them (box 5). More than 50 per cent responded that they were unable (or did not know how) to prove that their products complied with customer requirements.

Among the various problems the EEE industry has encountered so far, the following are the most critical: the costs associated with obtaining and providing "proof of compliance" to meet diverse, and sometimes inconsistent, requirements by different customers; a lack of competent analytical services; and insufficient knowledge of materials used and weak supply chains, especially at the upstream levels. It is generally agreed that all stakeholders must work together to find common

Box 5. MTEC survey

MTEC conducted a survey among producers of the most important categories of EEE exported to the EU market. Out of 100 companies, 69 answered the questionnaire and granted factory visits. The following summarizes the results of this survey:

- **Awareness of the EU WEEE and RoHS Directives:** 16 per cent said they were well aware and followed the development closely, 67 per cent had some awareness, and 19 per cent had no knowledge of the Directives;
- **Impact of the RoHS Directive**: 74 per cent believed the RoHS would have a direct impact on their business, 12 per cent believed it would have an indirect impact and 2 per cent were not certain;
- **Problem substances:** Lead was mentioned by 86 per cent of respondents, polybrominated biphenyls andpolybrominated diphenyl ethers by 28 per cent, cadmium by 14 per cent, chromium (VI) by 5 per cent and mercury by 5 per cent;
- **Ability to stop using the restricted substances:** 21 per cent responded that they could stop using them instantly, 65 per cent could not stop for the present, and 12 per cent did not answer;
- **Barriers to adjustment:** cost of the substitute materials was listed by 47 per cent of respondents; lack of information about the substitute materials by 40 per cent; lack of technology by 39 per cent; lack of local suppliers by 37 per cent; lack of supporting infrastructure in the country by 33 per cent; lack of personnel with adequate technical background by 32 per cent; inability to comply without affecting other qualities by 23 per cent; and lack of capital by 18 per cent;
- **Factors that would enable efficient transformation:** respondents listed technology (proper technology, information, technical personnel and specific know-how), infrastructure (structures for proving compliance, efficient materials certification system, tax structure and corporate clustering), and adequate management and well-functioning markets; and
- **Areas that need government assistance**: respondents listed technical aspects (technology transfer, R&D, information) as well as policy aspects (investment promotion via tax incentives, tariff reduction on imported machines for the adjustment of production lines; local market alignment through national RoHS enforcement, and international trade negotiations).

practices and/or solutions that all parties can accept. With a strong corporate alliance, producers can make a smooth and cost-effective transition to renouncing hazardous substances and they can make further improvements to become competitive providers of eco-products. To this end, the "Thai RoHS Alliance" has been established and some initial activities planned (box 6).

Thailand also exports EE products to Japan where stringent environmental legislation, particularly the HARL, has been enacted. Although the ultimate objectives of the European WEEE and RoHS Directives and the Japanese HARL are similar, their approaches are different. Thai producers experience considerably fewer difficulties in complying with the HARL than with the RoHS. The reasons for this could be the following:

Unlike the very broad product coverage of RoHS, the HARL covers only four appliances and does not explicitly prohibit the use of certain hazardous substances; HARL only prohibits their release into the environment.

The responsibility for recycling and properly treating all substances that are toxic to the environment is left to the producer. With years of preparation, the Japanese producers have the necessary infrastructure to retrieve all discarded and hazardous substances used in their products. Under this system, producers can choose the approach that works best for them to comply with the law.

The market for the four appliances is dominated by a limited numbers of "big-brand" companies, all of which are capable of ensuring that their products meet the HARL standards.

Box 6. The Thai RoHS Alliance

The Thai RoHS Alliance (also known as the Thai-RoHS Networking Initiative) groups manufacturers across the EEE supply chain, research institutes, testing laboratories, and private and government organizations. It initially aims at pooling efforts and resources to enable producers in Thailand to comply with the requirements of the RoHS Directive. So far, the efforts of Thai producers to comply with the emerging requirements have not been coordinated and companies have regarded each other more as competitors than allies. The RoHS Alliance seeks to address these difficulties, recognizing the need for a systematic approach and for nationwide collaboration. The Alliance was launched on the occasion of the Fourth Eco-Materials Seminar organized by MTEC in collaboration with the Federation of Thai Industry, the Electrical and Electronics Institute, the Pollution Control Department and the Department of Industrial Works on 16 September 2004. Over 340 participants from 130 companies agreed on the need for all stakeholders to cooperate in establishing necessary structures to enable the country to address new requirements as well as to increase the competitiveness of Thai products. In fact, the aim of the Alliance has gone beyond that; its long-term objective is to enhance the competitiveness of the Thai EEE industry, and in particular to strengthen SMEs, by providing a platform for members to exchange ideas and share experiences. Examples of initial activities include the development of codes of conduct, guidelines and practical test methods. However, still in its infancy, the Thai RoHS Alliance has experienced several difficulties that limit its ability to pursue proactive strategies. Although most participants recognize the mutual benefits it could bring, only a few are in a position to share information and make commitments without first consulting with their headquarters. To be able to move forward, the Alliance needs support and collaboration at the national and international levels.

Information management

In general, information on new and forthcoming environmental and health requirements in export markets is collected and disseminated by governmental institutions to the private sector. The foreign offices of the Ministry of Commerce report relevant information to the capital and the Ministry then circulates draft working papers to concerned government offices, such as the Ministry of Industry, and to industry and professional associations, such as the Federation of Thai Industries, the Thai Medical Equipment Producers and Suppliers Association, or the Thai Computer Association. On major issues, consultations take place among the relevant offices to determinate official positions and to identify and address problems.

Adjustment strategies

During the period 2003–2004, several activities were undertaken aimed at speeding up the industry adjustment process. MTEC, the Federation of Thai Industries, the Thai Electrical and Electronics Institute, the Pollution Control Department, the Department of Industrial Works, the Thai Environment Institute, the foreign offices of the Ministry of Commerce and the National Economic and Social Development Board (NESDB), were among the key players that initiated and supported these activities. The most frequently conducted activities were regular public seminars/workshops, and the most notable actions at the national level were the drafting of the Thai E-waste Control Law by the Pollution Control Department and the draft Thai Green Procurement Initiative of the NESDB.

Actual adjustment processes in the industry to comply with RoHS requirements started around the second half of 2003, when most TNC subsidiaries received management orders from their headquarters. Most TNCs established their own deadline for phasing out restricted hazardous substances, in general no later than mid-2005 (i.e. before the deadline established by the RoHS Directive). In most cases, TNC requirements are stricter than those of the RoHS Directive. Different companies have different approaches, but most companies are required to adjust their materials management system, and to realign/re-qualify all suppliers for proper RoHS compliance. It is

the responsibility of the producers in the supply chain to provide satisfactory proof of compliance. Since there are as yet no official criteria, proof of compliance has become the most troublesome task for both vendors and purchasers. To be able to work under such uncertain circumstances, buyers tend to protect themselves by imposing strict measures while gathering as much information from suppliers as possible. As a result, the suppliers are often overloaded with complex technical questions. In addition, for the maximum concentration limit values (MCV), most purchasing companies use a "safety margin" to make sure that their products meet customers' requirements. As a result, by the time the order reaches the 3rd, 4th or 5th tiers, of the supply chain there is little or no margin left, with limit values, in many instances, as low as 1 ppm (parts per million). Consequently, often it is the weakest link in the supply chain that is confronted with the greatest challenge.

MTEC supports this adjustment through the establishment of a Trace Element Analysis Lab (TEA-Lab), which serves as a contact point for companies that need technical assistance in substituting banned materials. The TEA-Lab also provides fundamental support for proof-of-compliance tests, which have become the most critical part of the adjustment process. Its primary focus is on materials used in EE products, automobiles and consumer packages. In addition to TEA-Lab, MTEC has published books and organized short courses on materials and impurities in electrical and electronic components. These courses provide basic background information so that industries can pinpoint problem areas and find proper solutions.

Legislation

Thailand has recognized the need to develop national legislation to address domestic environmental concerns over the growing generation and import of waste and second-hand EEE. A coherent domestic legislative framework would also enhance the preparedness of the country to respond to requirements for EEE in export markets. The Thai Government has thus set up a number of working groups to study and draft strategic plans to address the issue of EEE waste.

The Ministry of Industry proposed legislation in 2003 to regulate the import of used EEE. The import of 29 items of used EEE (mainly household appliances) requires permission by the Department of Industrial Works. Criteria for approval include the age of the used equipment, product standards, quality guarantees, the economic feasibility of recycling and disposal and the capabilities of Thailand's recycling facilities. In addition, the Ministry of Industry has developed a number of directives, including the Directive of Industrial Standards for Separation and Recycling Facilities for Electrical and Electronic Equipment, and the Directive of Industrial Policies on Electrical and Electronic Products. The latter sets minimum levels of recycled inputs that have to be used in the manufacture of EEE, and establishes the obligation to label products with the manufacturing date in order to separate old products from new ones. Moreover, a draft Directive on Types and Quantities of Hazardous Substances in Electrical and Electronic Equipment covers the same substances as the EU's RoHS Directive, and applies to small and large household appliances, telecommunications equipment, lighting products, electric and electronic tools, toys, sports equipment, and electrical and electronic entertainment equipment.

The Ministry of Natural Resources and Environment, in cooperation with the Ministry of Industry and other relevant government and private agencies, has been developing the National Strategic Plan for the Environmentally Sound Management of E-waste (or waste from electronic equipment). The main objective is to improve the existing separation and collection system of EEE waste and to manage such waste properly. The Strategic Plan is based on the polluter pays principle, allocating shared responsibility to producers, importers and consumers for the environmentally sound management of EEE waste. In the short run, the Plan envisages a pilot project for a collection system for used mobile phones and their batteries, a feasibility study on fluorescent lamp recycling, and a programme to foster public education and R&D. In the long run, the Plan aims at the development of comprehensive legislation and the establishment of a specific fund for

Box 7. Technical issues relating to RoHS adjustment in Thailand

The EE industry needs a variety of materials to produce appliances with cutting-edge performance. Basic materials generally lack the desirable properties and often need to be modified to achieve the required characteristics. Before the announcement of the RoHS Directive, many EE companies in Thailand, particularly producers of components and providers of manufacturing services in the supply chain, used modified materials without knowing their exact content. Even though most EE producers became aware of the RoHS Directive, in general they lacked an understanding of the complexities of the materials they used, and therefore underestimated the implications of the RoHS and, hence, the time required to achieve RoHS compliance.Before suitable material substitution strategies can be formulated, an assessment has to be made of the elemental content of all materials employed in the products, their functions, and the possible impacts of the phase-out of restricted substances. Once restricted substances are removed and control procedures put in place, the product can be certified as RoHS compliant. In practice, however, RoHS adjustments may be more complicated.

Customers that are brand owners usually dictate the product design and/or the choice of key parts to their suppliers. Most SMEs in Thailand receive materials from large producers, either local or overseas. Therefore, the real challenges for most Thai producers are not finding alternative materials but finding competent suppliers, establishing a cost-effective materials control programme, finding ways to verify and guarantee compliance, and building up the experience necessary to master new processes. This requires technical and management skills collaboration throughout the whole supply chain.
Delays in the announcement of how the RoHS Directive would be enforced and compliance shown have complicated the adjustment process. For example, uncertainties about maximum concentration limit values (MCV), standards and analytical tools to be used for determining contamination levels and the data required for the approval and or verification process, have created additional problems for producers in the EE supply chain. To meet the deadline of the RoHS Directive, many materials and parts must be verified no later than mid-2005. Because of the lack of official criteria, many EEE producers would be assuming worst-case scenarios and safeguarding themselves by imposing strict requirements for compliance by suppliers. Most brand owners, particularly TNCs, have set their own standards. These "customer standards" may differ in details, but generally require suppliers to set in place materials and environmental control systems and to provide proof of compliance by means of analytical testing. These requirements mandate materials testing, systematic controls, and business-to-business audits. EE producers with multiple customers will face multiple audits. The adjustment costs arising from these "second-tier" effects can be significant.

Source: Nudjarin Ramungul

EEE waste management. The Ministry has been drafting a Law for the Promotion of Hazardous Waste Management, which includes EEE-waste management. The draft legislation includes product coverage, the introduction of a product charge and the establishment of a specific fund for EEE-waste management and its administrative body, as well as the establishment of a take-back system for a number of end-of-life products. It emphasizes waste minimization, focusing on the 3Rs (reduce, reuse, recycle). Finally, it defines liability and penalties in case of violation.

Other initiatives

Thailand has also developed its own national eco-labelling programme, the Thai Green Label Scheme, which was initiated by the Thailand Business Council for Sustainable Development in October 1993 and formally launched in August 1994 by the Thailand Environment Institute in association with the Ministry of Industry. This initiative was developed with the objectives of generating awareness among consumers and producers alike on environmental impacts that occur during the manufacture, use, consumption and disposal of products, and of creating a market incentive for manufacturers to supply environmentally sound products. The programme thus aims at making tangible progress in materials recovery and resource preservation. Criteria have been developed for 35 product categories, including a number of electrical and electronic products such as refrigerators, washing machines, computers, photocopiers, facsimile machines, mobile phones,

air conditioners, energy-efficient motors, energy-saving fluorescent lamps and electronic ballasts. Criteria for additional product categories are currently being developed, including for television sets. To date, 144 products have been awarded the label, of which 66 are electrical and electronic products. [83]

Recommendations

The Thai Government and private sector have been working together to be able to meet new environmental requirements for EEE, enhance international competitiveness and maintain export growth. However, as technological progress has been limited, Thailand needs technical assistance and support from developed countries and the EU, especially in the area of environmentally sound technology and eco-design. Developed countries and TNCs should provide their Thai partners with enough tools and technical knowledge to enable them to understand the rationale and essence of the environmental protection measures so that they can implement adjustment measures to protect both the environment and corporate interests. R&D should be strongly supported, especially in the areas of substitute materials for the production of EEE, and design for the dismantling and reuse of equipment and for waste treatment. It is also important to support joint ventures between Thai companies and trade partners to develop and transfer technology for materials substitution and waste treatment.

4. Comparison of adjustment processes in the three developing countries

Differences in the characteristics of the EEE industry in China, the Philippines and Thailand (e.g. in terms of structure, ownership and sales strategies) play an important role in determining the implications of environmental requirements on specific segments of their EEE sectors and the required national adjustment strategy. The EEE industries in China and Thailand use relatively more locally produced parts and components than those in the Philippines and also involve more SMEs. A number of domestic manufacturers in China and Thailand produce not only components but also end products. Until now, Chinese products have been exported under foreign brand names, but some leading companies are starting to sell their own brands.

All three countries are starting to implement proactive policies, but only with regard to information gathering, management and dissemination. However, there is no systematic gathering of relevant information on environmental requirements either by governments or the private sector. Information flow is generally slow, the potential of TBT inquiry centres is poorly exploited, and the communication links between government offices and between these and industry associations are weak. China and Thailand are setting up early warning systems. Some efforts have been made to enhance the level of understanding of the likely implications of new environmental requirements. The Governments of China and Thailand, in close consultation with relevant industry associations, have assessed the impact of the EU's WEEE and RoHS Directives and have also had consultations with the European Commission on these Directives.

In China it is primarily the Government that drives the adjustment process. In Thailand the Government had a key role in initiating the adjustment process, in particular through the creation of a subcommittee. The ongoing adjustment approach is the result of a coordinated effort between government bodies, industry associations and academic institutions, in particular through the Thai RoHs Alliance. In the Philippines, adjustment to external requirements is driven by the subsidiaries of TNCs and by large contract manufacturers.

China and Thailand are implementing legislation to respond to external environment-related requirements as well as to address domestic problems related to EEE waste. China seems to have adopted an ambitious approach; it is developing a legal framework with similar targets and time frames as the EU RoHS Directive. It remains to be seen how the Chinese authorities will be able to effectively enforce such an ambitious regulatory framework and how it will function once implemented. Enhancing the role of and funding for SEPA will be important.

F. Conclusions and Recommendations

1. Specific conclusions concerning the EEE Sector

The following conclusions can be drawn for the EEE sector:

- The EEE industry in general, and the IT industry in particular, is largely based on a global supply chain. Globally implemented supply chain management will have to ensure adjustment to the new environmental requirements. SMEs that provide inputs into manufactures for export are often made part of global supply chains. Increasingly stringent environmental requirements may provide incentives to standardize components (and reduce their number) and cut down on the number of suppliers, which would also affect SME suppliers. SME alliances may help to address this risk;
- Rapidly growing domestically generated EEE waste and imports of second-hand IT equipment threaten to affect human health and the environment in the key IT- exporting developing countries. It is therefore effective and cost-efficient to combine adjustment to external requirements for exported EEE with an adjustment to internal requirements for sound EEE waste collection and management that goes beyond mere recycling;
- There is a need for empirical analysis of the current and potential size of national recycling, reconditioning and reuse markets, and of appropriate policies for stimulating collection, recovery, reuse and recycling of material. Options for subregional cooperation in recycling should also be examined;[84]
- Concerned developing countries cannot simply copy the collection and recycling systems used in developed countries, because of the peculiarities of supply of and demand for waste from EEE. Specifically, (a) in the second-hand market for EEE, product refurbishing/repair play a far more important role (in fact the second-hand market is often much bigger than the original equipment market); (b) SMEs play an important and cost-efficient role in collection and refurbishing/repair of EEE waste; and (c) collection, repair, refurbishing and disassembly can offer ample business opportunities for SMEs;[85] and
- Concerned developing countries may also exchange national experiences and cooperate in the development of eco-design of EEE manufactured for domestic or regional markets.

2. Trends in environmental policies, and implications for developing countries

The following general trends can be identified from the case study of the EEE sector:

- While growing volumes of waste from EEE and associated environmental and health problems are an issue of concern in many countries, policy responses have varied, particularly in the choice between government regulation versus reliance on private-sector initiatives to achieve environmental objectives;
- Environmental policies are increasingly based on the principle of *producer responsibility,* in particular in dealing with end-of-life environmental impacts;
- The EEE sector illustrates the growing involvement of policy-makers and regulators in innovation and product design. This raises the following issues: (a) the respective roles of government and private-sector initiatives; (b) the need to take into account different conditions and needs of developing countries; and, consequently, (c) the enhanced need for consultation and coordination of key environmental policies; and
- Trade issues do not figure prominently in national discussions and consultations on policies concerning waste from EEE, except for concerns about (a) the functioning of the EU's internal market, and (b) exports of EEE waste to developing countries, in particular from the United States. Ex-ante impact assessments of EEE waste policies, if at all conducted, have seldom, if ever, included developing countries. Also, developing-country exporters have not often been involved in stakeholder discussions.

All this has important implications for developing countries, including the following:

- Product standards and regulations entailing substitution of hazardous substances may re-

quire significant efforts in terms of R&D to identify cost-effective substitutes, as well as long periods to adjust production processes to work with such substitutes. In this regard, it is important to note that material substitution is a complex process that might affect capacity, requires a certain lead time to effectively work with substitutes, and is subject to sourcing limitations in cases where substitutes and/or related processing technology are under patent protection. TBT notification provisions apply across the board and do not adequately reflect the complexity of product and process requirements resulting from stringent environmental standards.[86] Producers in developing countries will increasingly have to respond to customers' requests for environmental information concerning their products; and

- Large companies may switch to more reliable, large suppliers at the expense of SMEs. For example, increasing demand for "lead-free" supply chains may result in the phasing out from the supply chain of a number of SMEs that are unable to provide lead-free solutions (Kumar and Charter, 2003).

3. Recommendations

A number of recommendations are made at different levels:

Recommendations to regulatory and standards-setting authorities and donors

- Greater efforts should be made to identify, as early as possible, the likely trade, developmental and social implications for developing countries, and to disseminate information on new environmental requirements to key developing-country exporters and their governments;
- There is a need for a user-friendly manual that explains the implications of new environmental regulations for developing countries and provides information about available technical cooperation/capacity-building programmes to assist them in meeting new requirements and implementing domestic standards;
- In their stakeholder consultations and regulatory impact assessments, developed countries need to pay more attention to the trade implications of new environmental regulations and the effects these can have on developing countries, with special attention to SMEs.
- Developed countries should be more proactive in facilitating the participation of significantly affected developing countries in stakeholder consultations; and
- Supportive and flanking policies of governments should pay special attention to addressing constraints and offering opportunities for developing countries.

Recommendations to governments and businesses in developing countries

- Develop coherent and proactive adjustment policies, fully involving all concerned stakeholders, with special attention given to the conditions and needs of SMEs and to promoting cooperation among them. Such adjustment policies are necessary to strengthen their participation in this dynamic sector of international trade, which constantly offers new areas of opportunities;
- Developing countries, in general, have not participated proactively in consultations during the development phase of the EU's WEEE and RoHS Directives. They should now participate in the consultations on the modalities of implementation of both the EU Directives, in particular the RoHS, as China did in February 2005. They also need to participate in consultations relating to Japan's HARL;
- Define and improve the use of national product standards (including consideration of the option of implementing more stringent export standards);
- Implement cost-effective eco-design programmes;
- Establish early-warning mechanisms, at the national level and, where appropriate, the subregional or international level, along with related easing of access to information on new environmental requirements. In addition, assess the likely impacts and adjustments to be made; and
- Strengthen environmental management systems in developing countries, in particular ISO 14001, as a means of improving environmental performance and facilitating compliance

with requirements in domestic and international markets. ISO 14001 registrations should pay more attention to product-related aspects, and should consider eco-design to facilitate compliance with requirements such as RoHS and other, emerging regulations, including those relating to energy-using products.

Recommendations to the international community, including the business sector

- In the TBT notification process, take into account the fact that the time and adjustments required to meet new regulations may vary considerably. For example, the analysis of the EEE sector shows that the phasing out of certain substances requires long adjustment periods as well as precise information on threshold levels and compliance procedures. Further analysis may also be needed of the implications of the obligations inherent in environmental regulations being transmitted to producers in developing countries through the supply chain;
- Benefits might accrue from the exchange of national experiences on adjustment approaches as well as from exploring cooperative subregional approaches to adjustment (including standardization, testing, conformity assessment and information management);
- Promote realistic and cost-effective product design programmes in developing countries, including through South-South cooperation. Access to environmentally sound technologies and material substitutes, and their effective use, play an important role in this regard;
- In the light of the important role of foreign subsidiaries in exports, in particular of electronics products, industry associations can play an effective role in a proactive agenda; and
- Special attention should be given to the conditions and needs of SMEs.

UNCTAD's consultative task force on environmental requirements and market access for developing countries (CTF) and other initiatives can play a useful role in promoting a constructive dialogue between developed and developing countries and in enhancing an understanding of trends in environmental requirements and of appropriate adjustment policies in developing countries.

ANNEX 1
EEE WASTE AND THE BASEL CONVENTION

Constanza Martinez, Secretariat of the Basel Convention

Introduction

The Basel Convention was adopted in 1989 to establish a control system for the transboundary movements of hazardous wastes and standards and to treat waste in a manner that is not harmful to human health and the environment. Whereas developed countries adopted legislation on waste management and disposal a long time ago, many developing countries still have no, or limited, provisions establishing standards. More importantly, even when legislation is in place, many developing countries lack the capacity to effectively implement such legislation. Over time, the treatment and disposal of waste in developed countries have become more costly than in developing countries, thus creating an incentive to ship waste to developing countries.

The Basel Convention seeks to protect human health and the environment from the possible adverse effects of waste by establishing a control system of transboundary movements. Transboundary movements are permitted under the Convention only when there is a guarantee that the waste will be managed and disposed of in an environmentally sound manner. The Convention thus focuses much of its work on increasing the capacity, especially in developing countries, of environmentally sound management of domestic and imported wastes. It also seeks to promote the minimization of waste generation in terms of quantity and hazardousness. In this respect, the Basel Convention takes the life-cycle approach to prevent and minimize the generation of hazardous wastes, and even participates in processes to set specific standards for manufacturing.

With the adoption in developed countries of national legislation setting high environmental standards for the management and disposal of EEE waste, companies have a financial incentive to ship such waste to countries that lack such legislation (or have little of it) and even where legislation is in place, lack the necessary infrastructure to control this waste stream. Often, electrical and electronic products that are near their physical end of life are shipped to developing countries for resale. Without an established international system for sharing the financial burden of treatment and disposal of these products once they become waste, countries with less capacity and inappropriate infrastructure to dispose of such EEE wastes end up bearing the cost of the treatment and ultimate disposal, frequently resulting in adverse effects on human health and the environment.

The Basel Convention today faces the complex challenge of assisting developing countries to establish appropriate national legislation and the necessary infrastructure, and acquire the necessary capacity to treat, manage and dispose of what becomes EEE waste once it is shipped under the label of second-hand products or end-of-life equipment.

Electrical and electronic waste within the scope of the Basel Convention

The Convention regulates wastes that belong to any category listed in Annex I of the Convention, which possess one or more of the characteristics contained in Annex III. Electronic wastes normally contain some of the substances with hazardous characteristics listed in Annex I, depending on the concentration. However, on the occasion of the adoption of an amendment to the Convention that prohibited the transboundary movements of hazardous wastes from member States of the OECD, the EC and Liechtenstein to the remaining Parties, Parties to the Convention felt that the scope of the Convention should be further defined. Two additional annexes, Annex VIII listing categories of wastes considered hazardous under the Basel Convention, and Annex XIX listing those that are not considered hazardous under the Convention, were adopted for ease of practical identification of specific wastes.

Annex VIII lists electrical and electronic waste as item A1180:

> *"Waste electrical and electronic assemblies or scrap containing components such as accumulators and other batteries included on list A, mercury-switches, glass from cathode-ray tubes and other activated glass and PCB-capacitors, or contaminated with Annex I constituents (e.g., cadmium, mercury, lead, polychlorinated biphenyl) to an extent that they possess any of the characteristics contained in Annex III."*

Annex IX (item B1110) mirrors that entry by stating that EEE waste is not considered "hazardous" when it does not possess the components and does not present the characteristics established in A1180.

Components typically used in the production of EEE waste are also included in Annex VIII, such as "glass waste from cathode ray tubes and other activated glasses" (item A2010) and "precious metal ash from incineration of printed circuit boards not included on list B" (item A1150.) Item B1160 in Annex IX "precious metal ash from incineration of printed circuit boards not included on list A" mirrors entry A1150 in Annex VIII.

Information obtained through national reporting seems to indicate that Parties currently prefer to report these types of wastes under other categories, such as part of household waste (e.g. ozone-depleting substances in fridges). In addition, it is important to note that Annexes VIII and XIX are only complementary to Annexes I and III, which are the main sources of information to determine if a substance is subject to the Basel Convention provisions. Furthermore, the headings of Annexes VIII and XIX indicate that Annex III prevails as a source of proof to establish if a substance is hazardous or not.

It is also worth pointing out that the Basel Convention's control system also applies to waste shipments covering wastes that "are defined as, or are considered to be, hazardous by the domestic legislation" of the exporting, importing or transit country (Article 1.1(b) of the Convention).

In sum, EEE wastes may be subject to the Basel Convention procedures if the above-mentioned criteria are met. In such cases, exporting States are required to ascertain that the importing State has the requisite capacity to dispose of the goods (including recycling) in an environmentally sound manner before they permit EEE wastes to be shipped to that State.

End-of-life equipment

One of the main sources of EEE waste in some developing countries is the import of second-hand products and/or end-of-life equipment. The Basel Convention, according to the integrated life-cycle principle and the polluter pays principle, has a role in carrying out activities aimed at increasing capacity to treat and dispose of EEE waste and reducing its impact on human health and the environment.

To ensure the implementation of a life-cycle approach, and bearing in mind the objective of preventing and reducing the generation of waste, a process of standard-setting at the manufacturing stage seems to be called for. To this end, various developed countries have enacted legislation that regulates manufacturing processes of electrical and electronic products. However this is largely limited to technically and economically easing of dismantling and recycling, rather than enhancing waste minimization, extending product life, and easing repair and reuse. The development and harmonization of legislation in this area among Parties to the Basel Convention is essential, as manufacturers are increasingly establishing themselves in developing countries to, inter alia, avoid restrictions that arise from such standards.

When establishing appropriate legislation, and based on the polluter pays principle, countries need to work together to ensure compatibility among systems in order to distribute the burden of

costs. The question arises as to how to allocate responsibility, or a part thereof, among producers and exporters as well as exporting-country governments for the treatment and disposal of EEE waste when second-hand electrical and electronic products reach the end of their useful life (and become waste requiring disposal) in developing countries or countries that have few restrictions. Some developed countries have enacted legislation to address this issue. It is imperative that developing countries also establish systems to allocate responsibility among the different stakeholders, based on the *principle of producer responsibility* already in force in some countries, and make these systems as compatible as possible with those of other countries, as well as enforceable.

As a first step in the process of consultations among countries and stakeholders aimed at harmonizing legislation and policies, key definitions should be agreed upon. Thailand seems to be a good example of a country that has passed legislation which defines basic elements, such as a legal definition of second-hand IT equipment that reflects real demand and specific conditions for import of second-hand equipment and its handling (physical and moral end-of-life equipment). The Thai example shows that it is pertinent to establish such regulatory systems at national and international levels.

Ideally, definitional and regulatory measures on second-hand equipment should be made an integral part of a holistic national EEE waste management strategy in developing countries. Moreover, these should go beyond an exclusive focus on recycling and include elements such as extension of product life, repair-friendliness, reuse and refurbishment, and they should reflect the specific supply and demand conditions for second-hand equipment and EEE waste in the country. Once again, the Thai example provided in the paper is a step in this direction that ultimately minimizes waste generation.

What can the Basel Convention do?

The Basel Convention is now faced with the challenge of growing international trade in EEE waste and second-hand IT equipment. As the Convention is concerned with the setting of appropriate standards to protect human health and the environment, its work concentrates on capacity-building activities to improve legislative and institutional infrastructure in developing countries and to tackle the issue in a manner that benefits exporters, importers, producers and the civil society as a whole. Social and economic considerations need to be taken into account.

Promotion of consultations among the different stakeholders is essential in order to build a credible system that would not discourage investment or otherwise negatively affect the economies of developing countries in particular.

As a first specific series of activities, the Convention has launched an initiative for a sustainable partnership on environmentally sound management of end-of-life mobile phones. One of the main activities under the initiative is the setting up of a working group composed of mobile phones manufacturers, network operators, experts and Parties. This working group is currently developing a Guidance Document for the Refurbishment of Used Mobile Phones. The group is also in the process of identifying environmentally sound practices for recovery and recycling of mobile phones, for eventual replication in other interested countries. Other activities, such as an analysis of take-back schemes, also figure on the working group's agenda.

Broader in scope, a work plan on cooperation between the industry, the business sector and NGOs was adopted. In this context, the secretariat of the Convention has met with key computer equipment manufacturers in the United States and Japan to ascertain their interest in setting up a partnership programme for end-of-life computing equipment, similar to the partnership programme on mobile phones. The objective of this partnership would be to raise awareness in developing countries of the need to build capacity to refurbish and recycle EEE waste in an environmentally sound manner.

The secretariat of the Basel Convention is also in contact with the United Nations University and the United Nations Environment Programme's Division of Technology, Industry and Economics (UNEP DTIE) to ensure that initiatives launched under the Basel Convention and within the mandate of the Parties are coordinated with the projects developed by these institutions.

In addition, the secretariat of the Basel Convention has submitted a proposal to include electrical and electronic waste, as defined in Annexes VIII and IX, in the World Customs Organisation's Harmonized System. The proposal is currently under consideration for inclusion in the next set of amendments that would be effective from January 2007.

The Basel Convention Regional Centre for Asia, based in China, is playing a major role in implementing a regional project which consists of collecting information on the volume of imports and exports of EEE waste in countries in the region. Based on the information obtained through its first phase, the project will aim at establishing a network at regional and national levels.

ANNEX 2
THE WEEE AND ROHS DIRECTIVES

The WEEE Directive requires the EU-25 member States to set up collection and financing systems for EEE by August 2005. By December 2006, the EU-25 are expected to meet the collection target (Article 5(5)) and recovery targets (Article 7(2)). New member States have been granted two years' extension (one year for Slovenia) for the deadline for meeting both the collection and recovery targets.

Product coverage

The WEEE Directive covers the following 10 product categories:

- Large household appliances;
- Small household appliances;
- IT and telecommunications equipment;
- Consumer equipment;
- Lighting equipment;
- Electrical and electronic tools (with the exception of large-scale stationary industrial tools);
- Toys, leisure and sports equipment;
- Medical devices;
- Monitoring and control instruments; and
- Automatic dispensers.

The RoHS Directive covers the same categories as the WEEE Directive, with the exception of medical devices and monitoring and control instruments. The Commission is to provide proposals for including these two categories in the scope of the RoHS Directive before 13 February 2005.[87]

Legal obligations of producers

Legal obligations under WEEE and RoHS Directives include:

- Compliance with RoHS;
  - From the 1 July 2006, producers will have to demonstrate that their products do not contain more than the maximum permitted levels of restricted substances.
- Compliance with the WEEE Directive;

  Financing of WEEE
  - Financing in respect of WEEE from private households (Article 8). From August 2005, producers have to finance the collection, treatment, recovery and disposal of household WEEE deposited at collection facilities. Producers can choose to meet their obligations either individually or by joining a collective scheme. They also have to guarantee that future costs for the collection and onward treatment, recovery and recycling of household WEEE will be met, even when they may cease to operate. They can do that by participating in an appropriate scheme for financing the management of WEEE, taking out "recycling insurance",[88] or opening a blocked bank account (where the money deposited is only released to pay for managing WEEE). With regard to "historic waste" (put on the market before August 2005), all producers have shared responsibility for financing the costs of collection and treatment of waste;
  - Financing in respect of WEEE from users other than private households (Article 9).[89] Producers are responsible for financing the costs of waste management.[90]

Recovery

- Producers (or third parties acting on their behalf) must arrange for meeting targets of reuse, recycling and recovery of WEEE product categories by December 2006 (see table); and

Product marking and disassembly information

- Producers will have to provide information to enable treatment facilities, reuse centres and recycling facilities to disassemble, reuse and recycle their products. They must also provide information on specific components and materials from equipment for separate treatment at end-of-life (such as batteries).

Table A2-1. Minimum end-of-life reuse, recycling and recovery targets set by the WEEE Directive

Product category	Component, material and substance reuse/recycling by average appliance weight (percentage)	Rate of recovery by average appliance weight (percentage)
Large household appliances	75	80
Small household; appliances	50	70
IT and telecommunications equipment	65	75
Consumer equipment	65	75
Lighting equipment	80	Not applicable
Electrical and electronic tools	50	70
Toys, leisure and sports equipment	50	70
Medical equipment systems	Target set by 2008	Target set by 2008
Monitoring and control equipment	50	70
Automatic dispensers	75	80

ANNEX 3
TRADE STATISTICS

This annex provides some trade statistics for the EEE sector. Table 1 shows trade estimates for the EEE sector based on 6-digit codes of the Harmonized System (HS) and using a definition largely employed by the Electrical and Electronics Institute, Thailand. This definition includes most of HS Chapter 85 and parts of Chapter 84 (in particular large household appliances and computers). However, a few products have been added from HS Chapters 90 (some copying equipment), 91 (certain watches) and 95 (certain electrical toys and video games).

Table A3-1. Selected developing countries: Exports of EEE, 2003 ($ billion)

	Electrical and electronic equipment			Total exports	Share of EEE in total exports (%)
	Total EEE	Electrical equipment	Electronics		
China	160.9	68.5	92.4	438.2	36.7
Philippines	25.5	1.8	23.7	36.2	70.4
Thailand	28.2	10.8	17.4	80.3	35.1
Malaysia	56.9	11.3	45.6	105.0	54.2

Estimates based on an adjusted definition of EEE

The rest of this annex shows the results of trade estimates for a sub-set of products selected on the basis of the list of products included in the annex to the WEEE Directive.[91] This sub-set has been created to enable a better estimate of the composition and direction of international trade flows in EEE products that may, in principle, be affected by the WEEE and/or RoHS Directives. The list excludes a series of products from the above-mentioned definition, such as electrical motors and generators (and their parts), wires and cables, and electrical apparatus for switching or protecting electrical circuits. It includes, for example, IT and telecommunications equipment (such as personal computers and cellular telephones), household appliances (such as air conditioners and microwave ovens) and consumer goods (such as video cameras). It also includes certain parts and components used for this equipment (such as parts and components for electronic equipment) because trade may be indirectly affected by the RoHS Directive and similar requirements of other countries.

The statistics in this annex are presented for purely illustrative purposes, and only in the context of the analysis presented in chapter 2 of this *TER*. It is to be noted that it is not possible to accurately identify EEE covered by the EU Directives in terms of the HS nomenclature. The WEEE Directive defines 10 broad categories of products covered by the Directive (Annex IB), and presents for each category a list of products that shall be taken into account for the purposes of the Directive (Annex IB).[92] Products that fall into these categories, and are not part of another type of equipment that does not fall into these categories,[93] may be covered by the WEEE and/or RoHS Directive. The trade flows shown in this annex may be overestimated to the extent that whether or not specific products are actually covered by the Directives may depend on factors such as size. On the other hand, Annex IB contains indicative, not exhaustive, examples for each of these categories.

In order to facilitate a comparative analysis, the same definitions have been used for other reporters (importing countries).

Table A3-2. Major markets: Imports of EEE by country/region of origin, 2003 ($ billion)

Importing Region	World	Developed countries	Developing countries				
			All	SE Asia*	China	Philippines	Thailand
World							
All EEE	844.6	273.1	528.8	433.7	169.7	30.3	24.8
Large household appliances	41.4	18.1	19.7	11.1	6.7	..	2.1
Small household appliances	25.3	8.9	15.5	13.6	11.2	0.1	0.4
IT and telecom equipment	602.7	194.7	383.8	325.7	98.5	29.5	17.7
Consumer goods	151.8	43.0	96.1	70.9	42.7	1.1	4.4
Other	23.4	8.3	13.7	12.3	10.6	..	0.2
Developed countries							
All EEE	446.0	124.9	298.7	237.1	107.1	14.0	13.5
Large household appliances	25.6	9.4	13.7	7.8	5.2	..	1.5
Small household appliances	17.4	5.7	11.0	9.5	7.7	0.1	0.3
IT and telecom equipment	300.0	85.0	204.1	168.9	61.5	13.2	8.4
Consumer goods	85.6	19.4	59.1	41.3	24.4	0.6	3.1
Other	17.3	5.3	10.9	9.7	8.4	..	0.1
European Union							
All EEE	165.8	49.3	97.9	81.1	34.1	4.6	4.2
Large household appliances	9.1	2.3	4.5	2.5	1.7	..	0.5
Small household appliances	6.4	1.8	4.0	3.7	2.7	..	0.1
IT and telecom equipment	112.8	36.1	68.4	58.5	19.2	4.5	2.9
Consumer goods	31.6	7.4	17.9	13.4	8.1	0.1	0.8
Other	5.8	1.7	3.1	2.9	2.5	..	0.1
Japan							
All EEE	58.5	12.0	48.3	39.8	17.9	3.3	3.4
Large household appliances.	2.2	0.2	2.0	1.8	1.1	..	0.6
Small household appliances	2.0	0.8	1.2	1.2	1.0	..	0.1
IT and telecom equipment	44.0	9.5	34.3	28.8	11.2	2.9	1.9
Consumer goods	9.3	1.1	8.2	7.2	4.1	0.3	0.8
Other	1.1	0.3	0.7	0.7	0.5	..	..
United States							
All EEE	172.6	35.7	134.6	100.4	48.1	5.3	4.8
Large household appliances.	8.7	2.7	6.0	2.7	2.0	..	0.2
Small household appliances	7.2	2.3	4.9	3.9	3.4	0.1	0.2
IT and telecom equipment	113.3	22.6	84.0	71.1	27.4	5.1	3.0
Consumer goods	35.6	6.6	28.7	17.5	10.7	0.1	1.4
Other	7.7	1.7	6.0	5.1	4.6	..	..
Canada							
All EEE	22.9	12.5	9.8	7.2	0.8	0.5	0.4
IT and telecom equipment	13.7	7.0	6.2	4.7	1.9	0.4	0.3
Switzerland							
All EEE	7.5	6.3	1.0	0.8	0.3	..	0.1
IT and telecom equipment	5.1	4.4	0.6	0.5	0.2	..	0.1

Source: UNCTAD, based on UN COMTRADE

*Except the Republic of Korea

Table A3-3. Selected South-East Asian countries: Exports of EEE, 2003 ($ million)

Selected country	World	Developed countries					Rest of the world
		All	EU	Japan	United States	Other	
China							
All	121 852.0	72 068.9	26 458.1	1 3213.3	30 076.6	2321.9	49 783.1
Household appliances	11 508.7	7 815.4	2 856.6	1 271.2	3 038.9	648.7	3 693.3
IT and telecom equipment	77 513.0	44 235.2	16 467.1	8 556.7	18 969.9	241.5	33 277.8
Consumer goods	26 327.9	15 290.6	4 951.0	3 127.6	6 212.5	999.5	11 037.3
Other	6 502.4	4 727.7	2 183.4	256.8	1 855.3	432.2	1 774.7
Philippines							
All	23 912.8	11 508.4	4 116.9	3 655.5	3 412.7	323.3	12 404.4
Household appliances	2 11.9	169.1	25.3	30.3	105.3	8.2	42.8
IT and telecom equipment	23 157.5	10 991.7	4 042.5	3 470.8	3 193.7	284.7	12 165.8
Consumer goods	5 14.0	328.4	40.4	153.6	104.7	29.7	185.6
Other	29.4	19.2	8.7	0.8	9.0	0.7	10.2
Thailand							
All	22 234.9	11 121.8	3 619.3	3 088.6	3 910.5	503.4	11 113.1
Household appliances	2 262.7	1 247.9	277.9	597	229.6	143.3	1 014.9
IT and telecom equipment	16 354.4	7 478.9	2 785.0	1 985.2	2 514.6	194.1	8 875.5
Consumer goods	3 456.0	2 302.7	518.4	488.6	1 142.0	153.7	1 153.3
Other	161.8	92.4	38.0	17.8	24.3	12.3	69.4

Table A3-4. Selected South-East Asian countries: Structure of EEE exports by destination, 2003 (%)

Selected country	World	Developed countries					Rest of the world
		All	EU	Japan	United States	Other	
China							
All	100.0	59.1	21.7	10.8	24.7	1.9	40.9
IT and telecom equipment	100.0	57.1	21.3	11.0	24.5	0.3	42.9
Philippines							
All	100.0	48.1	17.2	15.3	14.3	1.4	51.9
IT and telecom equipment	100.0	47.5	17.5	15.0	13.8	1.2	52.5
Thailand							
All	100.0	50.0	16.3	13.9	17.6	2.3	50.0
IT and telecom equipment	100.0	45.7	17.0	12.1	15.4	1.2	54.3
Total							
All	100.0	56.4	20.4	11.9	22.3	1.9	43.6
IT and telecom equipment	100.0	53.6	19.9	12.0	21.1	0.6	46.4

Notes

1 A new corporate social responsibility code for the electronics sector was launched by IBM, Hewlett-Packard and Dell in conjunction with a number of contract manufacturers on 21 October 2004. See www.hp.com/hpinfo/newsroom/press/2004/041021a.html. More information on the code is available at www.hp.com/hpinfo/globalcitizenship/environment/pdf/supcode.pdf. See also the commentary by Martin Charter and Ritu Kumar in this issue of the *Trade and Environment Review*.

2 In the EU, the total volume of electronic waste is more than eight million tons a year.

3 The period is somewhat longer in developing countries. In Thailand, for example, the average time of utilization of EEE is very long (e.g. 18 years for television sets and 7 years for computers) (Teeraporn Wiriwutikorn, 2004).

4 Hazardous substances in EEE do not pose any specific risk to the consumer, as there is no exposure to these substances during ordinary use. The main source of risk is via the disposal of EEE. Hazardous substances can leach from landfills and contaminate both soil and groundwater, thereby affecting human health through the food chain and drinking water. Landfill gases can also be emitted into the air. Hazardous substances are most dangerous to human health and the environment at high levels of concentration, or at low levels of concentration with prolonged exposure. The dismantling and treatment of waste from EEE may present a hazard to those employed in the waste management sector. Hazardous substances may also affect human health and the environment during the manufacturing of EEE (Department of Trade and Industry (United Kingdom), Explanatory Memorandum on European Community Legislation, at: www.dti.gov.uk/support/finalreport.pdf).

5 Including reduced toxicity and redesign of products for improved reusability or recyclability.

6 Policies often include an explicit "waste management hierarchy" as follows: (i) reduce, (ii) reuse, (iii) recycle, and (iv) recover (see also Canadian Council of Ministers of the Environment, 2004).

7 Individual responsibility may be difficult to implement in the case of highly mixed product waste streams such as packaging waste.

8 For example, legislation in the state of California includes provisions for hazardous materials that are based on the EU's RoHS Directive. China is in the process of developing its own RoHS directive.

9 Tischner et al. (2000), cited in Commission of the European Communities, Proposal for a Directive of the European Parliament and the Council on Establishing a Framework for the Setting of Eco-Design Requirements for Energy-Using Products and Amending Council Directive 92/42/EEC. COM(2003)453 final. Brussels, 1 August 2003: www.energie-cites.org/documents/opinions/proposition_directive_eco-conception_en.pdf.

10 In the case of the EU directives, for example, the focus has been on addressing internal market problems resulting from national approaches to EEE waste. Problems identified in the explanatory memorandum to the WEEE and RoHS Directives (COM (2000)347) include the following: "(a) Different national policies on the management of EEE waste hamper the effectiveness of national recycling policies, as cross-border movements of EEE waste to cheaper waste management systems are likely; (b) different national applications of the principle of producer responsibility lead to substantial disparities in the financial burden for economic operators; and (c) diverging national requirements on the phasing-out of specific substances could have implications for trade in electrical and electronic equipment." (http://pc-recycling.co.uk/pdf/weee/pdf).

11 Following concerns raised by the business sector about the potential negative effects of financing rules on historical waste from non-household sources, the European Commission amended Article 9 of the WEEE Directive (Directive 2003/108/EC of December 2003). According to the amendment, the financial responsibility for historical waste should be borne by producers only when they supply new products. Where such waste is not replaced by new products, the responsibility should be borne by users. Member States, producers and users should have the possibility to make alternative arrangements.

12 The RoHS Directive is often described as imposing a total ban on the listed substances. However, the Technical Adaptation Committee intends to establish maximum permitted concentration values for the listed substances in based on scientific and technical review. On 23 September 2004, the European Commission submitted a proposal for a Council decision (COM (2004) 606) to amend the RoHS Directive, setting a limit of 0.1 per cent by weight and per homogeneous material for lead, hexavalent chromium, mercury, PBBs and PBDEs, and 0.01 per cent by weight and homogeneous material for cadmium.

13 For reasons of proportionality, applications of the targeted substances, where substitution is technically or scientifically impracticable, or where the negative environmental impacts caused by substitution outweigh the possible environmental benefits derived thereof, are exempted from the substitution requirement or could be exempted via a committee procedure.

14 Excluding the Republic of Korea.

15 One such issue is the method to be adopted for producers to demonstrate RoHS compliance. As indicated elsewhere in this chapter, uncertainty surrounding this has been perceived as a major obstacle – for example,

by Thai producers. Recent indications are that self-declaration will be adopted as an efficient and cost-effective method to demonstrate compliance with RoHS, provided that the manufacturer has taken reasonable steps to comply with the legislation. Reasonable steps for RoHS compliance could include testing of materials, monitoring of supply-chain partners, and proper documentation.

16 *Reduce:* design for longer product life and more rational material use (e.g. television sets, refrigerators, washing machines, air conditioners, PCs); *reuse:* design for enhanced reusability (e.g. PCs, copiers); and *recycle:* design for enhanced recyclability (e.g. television sets, refrigerators, washing machines, air conditioners, PCs).

17 To ensure the system is effective, 36 major PC manufacturers have agreed to set up a joint collection system under the JEITA, which will use the national network of some 20,000 post offices in Japan (*Japan Times*, 1 October 2003).

18 In June 1995, the Government adopted the Action Plan for Greening Government Operations. The plan required government activities to become more environmentally friendly through the use of recycled paper and energy-saving equipment, the introduction of lower-emission vehicles, and the reduction of carbon dioxide (CO_2) emissions at all government facilities.

19 www.informinc.org/fact_JapanEPR.pdf .

20 www.productstewardship.net/PDFs/productsElectronicsEdesign.pdf.

21 Information on state legislation and local initiatives can be found, for example, on the National Recycling Coalition Website: www.nrc-recycle.org/resources/electronics/policy.htm. See also: www.computertakeback.com/index.cfm.

22 After 1 July 2004, electronic product manufacturers must demonstrate compliance with provisions of the Electronic Waste Recycling Act. Starting 1 July 2005, electronic product manufacturers must report annually to the Board their approximate sales of covered products for the preceding year, the amount of hazardous materials used in manufacturing their products, what they have done to reduce this amount, and efforts undertaken to design more recyclable electronic products.

23 The product coverage is limited to hazardous electronic devices (cathode ray tubes and other video displays); other electronic equipment, such as computers and printers, is not covered.

24 www.ciwmb.ca.gov/Electronics/Act2003/Workshops/6Feb2004/ExportFS.doc.

25 www.epa.gov/epaoswer/non-hw/reduce/epr/index.htm.

26 http://eerc.ra.utk.edu/clean/nepsi/.

27 www.energystar.gov/.

28 Examples can be found on the website of the Electronic Industries Alliance at: www.eia.org/new_policy/environment.phtml.

29 www.ccme.ca/initiatives/waste.html.

30 The CCME is also in the process of identifying and prioritizing electronic waste for industry product stewardship approaches, and of establishing best environmental/management practices for electronic waste processing.

31 www.epsc.ca/.

32 EPR is an environmental policy approach in which a producer's responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product's life cycle. It places the onus on the brand owners and initial importers of electronic equipment to collect and properly manage these devices when consumers have finished using them. In Canada, several mandatory and voluntary EPR-style programmes have already been established to address concerns regarding the hazardous nature and/or growing quantities of waste for end-of-life products, including used oil, paint, refrigerants, scrap tyres, batteries and beverage containers.

33 www.epsc.ca/E_News/ENews_Issue5_Oct04.pdf.

34 In the initial phase of the programme, televisions, computer monitors, central processing units (CPUs), laptops, electronic notebooks and printers are to be accepted for recycling. Starting in February 2005, an environmental fee, ranging from 5 to 45 Canadian dollars (depending on the item), was to be charged for each product included in the programme.

35 This is a more stringent obligation than the EU's WEEE, which stipulates that retailers (manufacturers and distributors) are liable to take back devices only if the consumer buys new equipment.

36 Municipalities have no mandatory take-back obligation, and are thus not obliged to provide for separate collection or collection points. For further details on ORDEA, see: www.umwelt-schweiz.ch/buwal/eng/fachgebiete/fg_abfall/abfallwegweiser/e-schrott/index.html.

37 As reported by the Association for Cities and Regions for Recycling: www.acrr.org/WEEE/weee_intro.htm.

38 www.swico.ch.

39 Includes the Swiss Association for Electrical Appliances: www.sens.ch.

[40] Assuming an exchange rate of £1 = $1.8.

[41] Partial Regulatory Impact Assessment of the WEEE Directive, March 2003.

[42] DTI recognizes that RoHS also may have an impact on the producers of the controlled substances (e.g. refined lead producers or zinc smelters that produce cadmium as a by-product).

[43] DTI expects that in the case of firms that are vertically integrated, R&D, production of components and final assembly of products will be done in-house, and that such firms will be affected at all levels. The restricted substances enter the production stream in the manufacturing of single components. Products that use these components may have to be adapted or redesigned to ensure that they function with the new components. Where this is the case, manufacturing firms towards the end of the supply chain will be affected indirectly.

[44] DTI, Partial Regulatory Impact Assessment on Directive 2002/95/EC of the European Parliament and of the Council on the Restriction of the use of certain Hazardous Substances in electrical and electronic equipment (RoHS Directive); accessible at: www.dti.gov.uk/sustainability.

[45] However, the European Parliament voted to remove a five-year exemption from the financing requirements of producer responsibility for small manufacturers (firms with fewer than 10 employees and a turnover of less than two million euros) (DTI, Partial Regulatory Impact Assessment of WEEE; and letter from Brian Wilson, MP, Minister of State for Energy and Construction to the Chairman, 23 May 2002).

[46] "Irrespective of the selling technique used" (i.e. including e-commerce).

[47] Where the subsidiary of a transnational corporation (TNC) in a developing country exports end products to the EU, the TNC in question is likely to be held responsible.

[48] Article 3 states that where companies market products under their own brand, which were originally manufactured by other companies, the definition of producer applies to the companies marketing the products rather than to the original manufacturers.

[49] According to Charter, Boyce and Burrell (2003, p. 13) it is likely that in European consumer markets Chinese companies will implement a market entry strategy that uses existing European brands rather than exporting under domestic brands. However, China's leading computer producer and exporter, the Legend Group, developed the brand name, "Lenovo", as part of its internationalization strategy.

[50] The Computer Aided Life Cycle Engineering (CALCE), Electronics Products and System Center, United States (http://www.calce.umd.edu/) found that environmental requirements have triggered many patents on lead (Pb)-free technology. One study argues that United States companies began patenting lead-free solders for electronic uses around the time of the Reid Bill in the early 1990s. European companies became active during the development phase of the EU's WEEE and RoHS initiatives. The bulk of the Japanese patents arose with the introduction of household appliances take-back legislation in the late 1990s. (CALCE, 2004).

[51] An interesting development in the EU is the European Commission's Better Regulations Package. It contains three important elements: (a) *Impact assessment* – proper assessment of compliance costs and administrative burdens of proposed legislation has been, and continues to be, extremely important to ensure a business environment that is conducive to competitiveness, innovation and growth. This applies to SMEs, in particular, as they are disproportionately affected by regulatory burdens; (b) *Consultation* – the Commission's upcoming general principles and minimum standards for consultation, as announced in the Action Plan, will help streamline and improve current practices and make them more transparent to the outside world; and (c) *Choosing the appropriate instrument* – in order to ensure a regulatory environment that favours competitiveness and innovation, policy-makers should use the least disruptive and most effective policy instrument.

[52] In 2004, three consultations were launched: pursuant to Article 5(1)(a) for fixing maximum concentration values; pursuant to Article 5(1)(b) for a number of exemptions requested by industry; and assessment of item 10 of the Annex to the RoHS Directive.

[53] Following the adoption of Regulation 1049/2001 on transparency and access to documents, the Commission introduced the open consultation process for soliciting inputs on areas for potential legislation (see: http://europa.eu.int/yourvoice/consultations/index_en.htmresults). The results of closed consultations are made public on the same website.

[54] The United States Government expressed "concerns that development of these directives lacked transparency and meaningful input from non-EU stakeholders and would adversely affect trade where viable alternatives may not exist" (United States National Trade Estimates Report to Congress, available at: www.ustr.gov/nte/2004.eu.pdf).

[55] At the 1999 Transatlantic Business Dialogue (TABD) CEO Conference in Berlin, the WEEE Directive was included among issues for "early warning" (i.e. issues brought to the attention of high-level United States and EU officials because they had the potential to lead to trade disputes). See: http://128.121.145.19/tabd/media/1999BerlinCEOReport.pd.

[56] http://europa.eu.int/comm/enterprise/enterprise_policy/gov_relations/japan_rrd/eu_japan_reform.htm

[57] www.amchameu.be/Press/2000/oct62000.htm

[58] The EU is the largest export market for the United States high-tech industry, accounting for $36 billion in 2002, and representing 16 per cent of that industry's total goods exports. The EU is also the largest destination for foreign direct investment (FDI) by the United States high-tech industry, which totalled $45 billion in 2001 - a 25 per cent increase over 1996 (Guhl, 2002).

[59] A large number of comments are available on the JBCE website: www.jbce.org/.

[60] http://europa.eu.int/comm/environment/waste/weee_index.htm#contributions

[61] In February 2005, the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China submitted a Chinese Stakeholders' Response to the Third Stakeholder Consultation on Adaptation to Scientific and Technical Progress under the RoHS Directive for the purpose of a possible amendment to the Annex.

[62] The Directorate General for Trade of the European Commission asked the research firm, Consultancy and Research for Environmental Management (CREM) (the Netherlands), to examine the best ways to develop and implement environmental legislation, particularly bearing in mind the interests of developing countries. The study, which focused on the WEEE and RoHS Ddirectives, was also to be used in the China-EU dialogue on environmental and health legislation.

[63] On 10 and 11 November 2003, AeA organized a seminar in Beijing with key officials of China's Ministry of International Industries in order to present the latest R&D work on Lead-Free Electronics and Recycling. The purpose of the seminar was to inform the Chinese officials of the technical challenges associated with the industry's conversion to lead-free technologies, and to establish an ongoing dialogue with those officials as more R&D in this important area is performed and deployed. (For more details, see: www.aeanet.org/GovernmentAffairs/gaet_EnvUpdate042704.asp).

[64] For details, see: www.deltha.cec.eu.int/spf/

[65] In the case of the WEEE and RoHS Directives, 30 and 41 months were allowed between their publication and the entry into force, whereas the TBT Agreement requires 60 days (WTO document WT/CTE/W/239).

[66] These studies were carried out by Professor Yang Changju, who led a research team from the School of Environment and Natural Resources, Renmin University, China; Dr. Phares Parayno, Chair of the Environmental Studies Program of Miriam College, Quezon City, the Philippines; Mr. Charuek Hengrasmee and Dr. Chirapat Popuang, leading a research team of the Thai Electrical and Electronics Institute, Bangkok.

[67] This section draws on a study by Professor Yang Changju, who led a research team from the School of Environment and Natural Resources, Renmin University, China.

[68] The CE (Conformité Européene in French) on a product is a manufacturer's declaration that the product complies with the essential requirements of the relevant European health, safety and environmental protection legislation, for example the so-called Product Directives.

[69] Chinese Stakeholders' Response to the Consultation on Adaptation to Scientific and Technical Progress under Directive 2002/95/EC of the European Parliament and of the Council on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment for the Purpose of a Possible Amendment of the Annex, 7 February 2005 (see: http://europa.eu.int/comm/environment/waste/rohs_consult.htm).

[70] The electromechanical products covered by the programme are: energy-saving lighting products, energy-saving computers, energy-saving and noise-suppressing air-conditioners, household refrigeration appliances, low-noise washing machines, low-pollution light vehicles, low pollution light motors, low-emission colour television sets, chlorine- and fluorine-free refrigeration appliances for industrial and commercial purposes, photocopying machines and kitchen appliances.

[71] The product groups that require the CCC Mark include: electrical wires and cables, switches for circuits, installation protection and connection devices, low-voltage electrical equipment, electric tools, household and similar use appliances, audio and video equipment, information technology equipment, telecommunication terminal equipment, medical devices and detectors for intruder alarm systems (for more information, see the official website of CCC Mark at: www.ccc-mark.com)

[72] This includes: revising the customs inspection and quarantine laws and rules on export of EEE; enhancing the global competitiveness of enterprises through certification, and providing electronics producers with good services to sustain the export of high-tech electronics; enhancing infrastructural capacity and investment in R&D.

[73] www.aeanet.org/GovernmentAffairs/gaet_EnvUpdate042704.asp

[74] This section is based on Parayno (2004). Chair, Environmental Studies Program, Miriam college Quezon City.

[75] The three leading exports of the Philippines in 2002 were: electronics (69 per cent); garments (6 per cent); and fresh and processed food (3 per cent).

[76] Around 30 per cent are owned by Japanese companies, 10 per cent by those of the Republic of Korea and 9 per cent by United States companies. European companies account for only around 7 per cent.

[77] The data for 2002 is obtained from the website of the Philippines Department of Trade and Industry: www.dti.gov.ph/contentment/9/16/20/233.jsp.

[78] 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.

[79] For example, the annual Materials Supply Day sponsored by Intel provides suppliers with an opportunity to discuss issues of concern and facilitates an exchange of views and information on strategies for environmental, health and safety (EHS) management.

[80] The Programme, known as "Green Choice Philippines", aims to: (a) guide consumers to choose products that are environmentally sound; (b) encourage manufacturers to adopt processes and supply products that have less adverse environmental impacts; and (c) use labelling as a market-based instrument that complements the Government's environmental policies and regulations.

[81] For a comprehensive and chronological overview of measures taken in Thailand to adapt to environmental requirements in the sector, see the presentation by Chuarek Hengrasme, President, EEI at the UNCTAD-UNESCAP workshop held in Bangkok, 25–27 May 2005.

[82] A bill of materials (BOM) defines the product structure in terms of materials. It provides a listing of all subassemblies, intermediate parts and raw materials that go into a parent assembly, showing the quantity of each required to make an assembly.

[83] A complete list of products covered and additional information on the Thai Green Label is accessible on the scheme's official website at: www.tei.or.th/bep/GL_home.htm.

[84] The economic rationale for regional cooperation in recycling has been recognized in the context of the WEEE Directive. "For various parts of WEEE, recycling is economically viable only if large quantities of waste are processed. According to the principle of economies of scale only a few centralized installations in Europe would process these wastes. Cathode ray tubes are an example of this situation. Sufficient quantities of this equipment could only be processed if WEEE were collected in several European countries." (Proposal for a Directive of the European Parliament and of the Council on Waste Electrical and Electronic Equipment, presented by the European Commission. COM/2000/0347 final - COD 2000/0158, Official Journal C 365 E, 19 December 2000, pp. 0184 – 0194).

[85] Households may prefer to sell discarded EEE to recyclers in the informal sector (even for a very low price), rather than returning it to collection centres or manufacturers without any compensation. Backyard recycling tends to be environmentally unfriendly. Yet the informal sector plays a potentially important role. There is a need for consumer education and the promotion of more environment-friendly waste management in the informal sector.

[86] As discussed in this article, the WEEE and RoHS Directives were notified to the WTO well before their publication in the Official Journal.

[87] Trade statistics presented in this article exclude medical devices and monitoring and control instruments (see Annex).

[88] Leading insurance companies are currently studying appropriate schemes and insurance premiums.

[89] Directive 2003/108/EC of the European Parliament and of the Council of 8 December 2003, amending Directive 2002/96/EC on waste electrical and electronic equipment (WEEE), OJ L345 of 31.12.2003, p. 106.

[90] For historical waste that is replaced by new equivalent products, or by new products fulfilling the same function, the financing of the costs shall be provided for by producers of those products when supplying them. Member States may, as an alternative, provide that users other than private households also be made, partly or totally, responsible for this financing. For other historical waste, the financing of the costs shall be provided for by the users other than private households.

[91] Excluding WEEE categories 8 (medical devices) and 9 (monitoring and control equipment) that are not currently covered by RoHS. The RoHS Directive also includes electrical light bulbs and luminaries in households.

[92] The Directive only covers products with a voltage of up to 1,000 volts for alternative current and 1,500 volts for direct current.

[93] For example, this annex excludes air conditioning equipment for use in motor vehicles.

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Commentaries

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Importance of the issue

There has been a major restructuring of the electronics sector with an increasing shift of manufacturing to countries particularly in East and South-East Asia. As underlined in this chapter, electronics and information and communication technology (ICT) products now represent a major share of exports from East and South-East Asia. The implementation of the WEEE, RoHS, EuP and REACH Directives in Europe, and the Home Appliance Recycling Law (HARL) and Law for the Promotion and Effective Utilization of Resources (LPEUR) in Japan will have major implications for designers and manufacturers in developing countries. The impacts will be transmitted primarily through international supply chains. A key problem, which the chapter correctly identifies, concerns the obtaining of accurate information. In addition to this, a problem perhaps more relevant to East and South-East Asian countries is that of getting early access to information.

Countries in the EU should have transposed the WEEE (Article 175) and RoHS (Article 95) Directives into national legislation on 13 August 2004. However, at the time of writing, only three countries had transposed the law: Finland, Greece and the Netherlands, and it is difficult to obtain information about the actual and prospective national transposition dates.

The first wave of developments in the EEE sector has focused on environmental aspects, which are well documented in this chapter. In addition, a number of United States companies launched the Electronics Industry Code of Conduct (EICC) on 21 October 2004, which includes social and ethical issues as well. Hewlett-Packard facilitated collaboration on the Code between itself, Dell, IBM and the electronics manufacturing companies Celestica, Flextronics, Jabil, Sanmina SCI and Solectron. This Code was recently developed to establish and promote unified industry expectations for socially responsible practices across the electronics industry's global supply chain. It potentially provides a route for a harmonized approach for monitoring suppliers' performance across several areas of corporate social responsibility, including labour and employment practices, health and safety, ethics and environmental protection. On 10 November 2004, Cisco Systems Inc., Hewlett-Packard, Microsoft and Intel Corporation announced the formation of a new supply chain working group to develop integrated implementation plans for the EICC. The new working group, facilitated by Business for Social Responsibility, will develop common mechanisms and tools to enable compliance with the code. The companies will work collaboratively with suppliers and partners in the supply chain to develop common approaches to supplier surveys, reporting methods, auditing tools, risk assessments and programmes. The joint effort reflects the participating companies' commitment to leadership in the area of corporate social responsibility and their desire to help suppliers streamline their reporting requirements and make performance easier to verify.

Salient differences in approaches to the problem of waste from EEE across developed countries/regions (EU, Japan, the United States)

Environmental issues are increasingly starting to have an impact on the global electronics and white goods (or home appliances) sectors; these developments will have significant implications for manufacturers and assemblers in developing countries that export or plan to trade with the EC, Japan and the United States. Particular drivers are a range of recent legislative developments focusing on eco-design, recycling and hazardous materials reduction in the electronics and white goods sectors.

In the EU this includes:

- Restriction of Certain Hazardous Substances (RoHS) Directive, passed in March 2003;
- Waste from Electrical & Electronic Equipment (WEEE) Directive passed in March 2003;
- Eco-design and Energy-using Products (EuP) Directive passed in early 2005;
- Proposed Registration, Evaluation and Authorisation of Chemicals (REACH) Directive; and
- The Communication on Integrated Product Policy (IPP) published in June 2003.

The scope of the WEEE and RoHS Directives covers 10 product categories, while EuP covers all energy-using products excluding cars. The WEEE and RoHS Directives will effectively come into force in 2005 and 2006 respectively. The annex to this chatper provides details of categories and targets covered by the Directives.

WEEE sets recycling/recovery targets for 10 categories of products (see below), and RoHS places a ban from 1 July 2006 on four heavy metals (lead, cadmium, mercury and hexavalent chromium) and the brominated flame retardants, PBB and PBDE, used in those products (with the exception of medical equipment under RoHS):

- Large household appliances (e.g. fridges and washing machines);
- Small household appliances (e.g. vacuum cleaners, irons);
- IT and telecommunications equipment (e.g. PCs, photocopiers, telephones);
- Consumer equipment (TVs, videos, hi-fi equipment);
- Lighting equipment (e.g. fluorescent lamps);
- Electrical and electronic tools (e.g. drills, sewing machines);
- Toys (e.g. video games);
- Medical equipment systems (e.g. radiotherapy);
- Monitoring and smoke equipment (e.g. smoke detectors); and
- Automatic dispensers (e.g. drinks machines).

Thirteen EU countries already have laws in place for electronic take-back, and it is estimated that within five years as many as 28 countries will have such legislation. In addition, the EU is currently expanding the directive on rechargeable batteries to cover a wider range. Currently 20 countries have a mandate for take-back of such batteries. Nine collection schemes are in force in Europe for recycling electronic waste, for example in Belgium, Denmark the Netherlands, Portugal and Sweden. In addition, an alliance has been formed between Sony, Electrolux, Braun and Hewlett-Packard to implement their own pan-European collection scheme.

Japan passed the Home Appliances Recycling Law (HARL) and the Law for the Promotion and Effective Utilization of Resources (LPEUR) in 2001. In addition, the Green Purchasing Law (GPL) was passed in 2001, which effectively created a green market for a number of publicly procured products. The chapter provides a good summary of these laws.

Unlike the EU and Japan, the United States has no national law covering WEEE and RoHS. However, various states are adopting a proactive stance. In 26 states, 52 electronic waste bills were proposed during 2003 as well as 65 mercury-related restriction bills, 10 of which affect electronics. At present 38 states have EEE-waste programmes of different kinds. California, Massachusetts, Maine and Minnesota have recently banned cathode ray tubes from landfill sites. Also recently, there was a development that will have implications for the greening of the global electronics supply chain. On 15 November 2004, the White House and 11 federal departments (i.e. the Executive Office of the President, the General Services Administration, the Environmental Protection Agency (EPA), and the Departments of Agriculture, Defence, Energy, Health and Human Services, Homeland Security, Interior, Justice, Transportation and Veterans Affairs) signed a memorandum of understanding to develop strategies to improve the quality, performance and environmental management of federal electronic assets. They will spend $50 billion on information technology (IT) equipment in fiscal year 2005, which represents 83 per cent of the federal Govern-

ment's total IT budget. The federal Government accounts for 7 per cent of the world electronics demand. The memorandum calls for increased reuse and recycling of federal electronic equipment and increased use of more energy- and resource-efficient equipment that aims to reduce life-cycle impacts and costs.

Lessons learned with regard to future environmental requirements (such as EuP)

There is a clear need for countries to set up early warning systems and get involved in the consultation process. The chapter cites some of the consultations undertaken by the EU when finalizing the WEEE and RoHS Directives. Another example which may be included is that of the REACH Internet consultations. These consultations, monitored by the EU between May and July 2003, invited comments and discussions from different stakeholders on the draft legislation. Similar consultations, inviting participation of suppliers from developing countries as well, should be organized for future environmental and social requirements. Countries should also consider establishing specific groups based in Brussels to keep an eye on developments and set up a regulatory watch or early warning system. This may be done either by industry associations or by country consulates.

How do these requirements affect developing countries?

With more outsourcing and contract manufacturing migrating to South and South-East Asia, and particularly China, there will be increasing requirements for suppliers to become more aware of environmental issues, especially product-related aspects concerned with materials reduction, energy efficiency, reduced toxicity and increased recycling. As described in the chapter, the impacts will be primarily due to increasingly strict supply chain requirements related to the RoHS Directive (e.g. removal of lead and cadmium). An additional implication of the RoHS Directive for developing countries concerns the testing and analysis of products and the technologies needed to do this. Sony, for example, has had to retrain 1,000 quality auditors to undertake testing and analysis of products to comply with RoHS.

Companies that have manufacturing facilities in Europe, and are deemed producers in Europe under WEEE, will also have to meet take-back and recycling requirements of the nationally transposed WEEE Directive. Problems may arise for many companies from South- East Asia that have sales/marketing offices in Europe (e.g. there appear to be 80 electronics companies from Taiwan Province of China in the United Kingdom alone), as many of them will not be aware that they are deemed to be producers under WEEE and they will have to join compliance schemes or make their own arrangements for recycling. This may well be an issue, but the biggest problem for the South-East Asian countries is posed by RoHS and its impacts through the supply chain.

An additional fear is that, given the limited time before the enforcement of WEEE and RoHS (i.e. 2006), many suppliers may be ignorant of the implications of these Directives. This will pose an enormous information management problem for companies at the top of and throughout the supply chain. The fact that the national transposition of WEEE and RoHS in EC countries has not met the August 2004 deadline should not mean that developing-country suppliers should become complacent – action will be required.

Information on the immediate impacts of "green" electronics laws and developments is needed. In the short term, the strictest rules are those found in Japan (e.g. as a result of HARL and LPEUR, which are voluntary agreements on removal of such substances as lead and cadmium). Sony has taken a particularly proactive and strict approach to the removal of these substances by its Asian suppliers through the implementation of its Green Partner Programme. However, there is a dearth of information in the "public domain" on the short-/medium-/long-term impacts of these developments.

An issue raised in the chapter that needs some attention is that of marginalization of smaller suppliers. If large companies and transnational corporations (TNCs) perceive a possible risk in their supply chain, they may switch to more reliable, larger suppliers, which could result in a loss of business for SME suppliers. For example, increasing requirements for lead-free supply chains (or networks) may result in a number of smaller suppliers, unable to provide lead-free solutions in time, being phased out of the supply chain.

What should be the strategy of developing countries?

Building upon the set of recommendations in the chapter, we have attempted to outline a five-point strategy for developing countries:

Set up strategy and management systems

- Identify and analyse specific environmental and social issues and the impacts on firms in the immediate, short, medium and long term; determine specific product-related environmental and social risks;
- Conduct high-level strategy meetings with senior management;
- Determine the appropriate positioning for brands and its business models relating to:
    - Environment, health and safety;
    - Sustainability (social, environmental and financial); and
    - Corporate social responsibility.

Set up appropriate organizational systems

- To provide an outline of organizational models that might be utilized to manage sustainability or corporate (social) responsibility issues on a worldwide, regional (e.g. Europe) and national basis;
- To analyse organizational models that competitors are using to manage sustainability and/or corporate (social) responsibility issues;
- To research appropriate job descriptions for different sustainability or corporate (social) responsibility positions;
- To help identify, recruit or headhunt appropriate staff to manage sustainability or corporate (social) responsibility issues;
- To determine immediate, short-, medium- and long-term cost implications of organizational development;

Set up information systems

- Determine the most appropriate structure for product-related environmental information systems designed to satisfy appropriate decision-making needs relating to:
    - Strategic (e.g. longer term) corporate strategy;
    - Tactical strategy (e.g. competition, new product development); and
    - Operational strategy (e.g. design, materials).
- Develop an Intranet site dealing with sustainability and/or corporate (social) responsibility issues, according priority to building a module on the management and technical requirements of WEEE, RoHS and EuP and the forthcoming REACH Directives;
- Determine immediate, short-, medium- and long-term cost implications of developing product-related environmental information systems;

Establish take-back and recycling systems

(Note: this is especially relevant for those companies that are deemed to be producers under WEEE in Europe).

- Research and create a list of recyclers and reverse logistics (take-back) companies with experience in business-to-business (B2B) relationships in the EU countries where companies are involved;
- Develop evaluation criteria and appropriate procedures for the selection of recyclers and reverse logistics (take-back) companies in EU countries;
- Determine the logistical issues associated with establishing reverse logistics (take-back) systems;

- Determine immediate, short-, medium- and long-term cost implications of establishing reverse logistics (take-back) and recycling systems;

Supply chain management

- Develop a supply chain management strategy that builds on product-related environmental compliance systems;
- Develop a product-related environmental risk profile amongst first-tier and strategic component suppliers and the broader supply chain – particularly focusing on the proposed requirements of RoHS and EuP and subsequently on REACH requirements;
- Develop a supplier training programme customized to the needs of target audiences. Such a programme may begin with a pilot for one supplier and then cascaded to other suppliers.
- Produce a booklet or downloadable checklist aimed at supporting suppliers on RoHS compliance (e.g. lead-free soldering, technologies);
- Develop a half-day workshop aimed at helping suppliers to eco-innovate (e.g. integrate environmental considerations into product development and design); and
- Determine immediate, short-, medium- and long-term cost implications of the integration of environmental considerations into supply chain management.

The role of government regulations versus industry initiatives in promoting eco-design

Government regulations and voluntary industry initiatives are equally important in promoting eco-design. A combination of standards set by governments, economic incentives provided by governments and voluntary, industry-wide initiatives are needed to make eco-design a priority amongst producers and suppliers.

Creating eco-design programmes in developing countries

Vossenaar et al., rightly recommend that businesses and governments in developing countries should develop and implement cost-effective eco-design programmes. For this to happen, it is necessary to develop knowledge clusters of industry training bodies, appropriate universities and research organizations. There is a need for simple but not simplistic tools. It is also important to learn lessons from the industrialized European countries (e.g. that eco-design is both a technical/engineering issue and a management issue). The experiences of companies and government-funded demonstration projects related to eco-design management can be useful. For example, the Dutch POEMS (Product-Oriented Environmental Management Systems) pilot project undertaken in the late 1990s is a good case study. The underlying rationale for the demonstration project was that previous government funding had involved free advice to companies on eco-(re)design of existing products, and when the project report had been completed, firms often reverted to "business as usual" (e.g. they failed to consider or integrate environmental aspects in product development processes (PDP)). Therefore there was a need to link eco-design to management systems (e.g. quality, environment or general) to ensure that environmental considerations were continuously integrated into the PDP.

Philip's has found that corporate and business units need a shared vision of the proposed outputs of the *process* (e.g. green flagship products). There is a need to establish a clear demarcation of responsibilities (e.g. at the product-level, environmental considerations are product-specific and should be left to business units to determine). Experience also suggests that to ensure the systematic and continuous *integration* of environmental considerations into the PDP, there is also a need to establish mechanisms to share and communicate knowledge throughout global supply networks. To ensure implementation, it is also essential to *sell* the commercial benefits of eco-design in the language of different business functions (e.g. to marketing in marketing language). If projects are sold only in sustainability/environmental language they will hit the "*green* wall" and move no further. Organizational learning and knowledge management are important tools, with more mature eco-design management systems likely to produce more eco-innovation.

What is the Sustainable Trade & Innovation Centre's (STIC) potential contribution?

STIC as an independent third-party organization, with partners in developing and developed countries, has the potential to assist suppliers in developing countries in a variety of ways that complement the five areas outlined in the section above. In particular, STIC can:

- Facilitate discussion between governments and companies in developing and developed countries on existing and forthcoming requirements;
- Assist suppliers in developing countries to meet environmental and social requirements in export markets through a range of capacity-building activities, including:
    - establishing management and organizational systems suited to new market conditions;
    - establishing take-back and recycling systems;
    - assisting innovation and eco-design through training workshops, in-factory assistance and pilot projects; and
    - Setting up a "regulatory watch" and appropriate information systems, as described above.

The Consultative Task Force, of which STIC is a member, is well placed to provide a forum for dialogue between developing and developed countries. This can be accompanied by additional capacity-building efforts where organizations like STIC can provide useful inputs.

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Producers, consumers and regulators are nowadays confronted with a significant increase in environmental policies, standards and technical regulations. The issuance of new and stricter standards dealing with environmental matters is not an isolated phenomenon. Rather, it is part of a global "standardization" trend aimed at increasing the productivity and efficiency of supply chains and at achieving higher levels of security and safety to better protect consumers, workers and the natural environment. Specifically, new standards and technical regulations are being developed to: protect human and animal life or health, plant health (phytosanitary regulations), the natural environment and wildlife; ensure human safety and national security; and prevent deceptive practices. This "standardization" trend has a dramatic impact on trade and on access to export markets by developing countries.

The paper by Vossenaar et al. provides a well-documented and clear assessment of two EU Directives (WEEE and RoHS) as well as related initiatives of other countries. It also explores how developing countries are addressing environmental and health-related problem associated with the growing volumes of post-consumer waste from electrical and electronic equipment. Through assessments carried out in key exporters of EEE, it further analyses how institutions and SMEs in developing countries are dealing with technological and marketing challenges to comply with the WEEE and RoHS Directives as well as similar regulations in other countries. Another important issue it addresses is related to weaknesses in accessing information on new standards and regulations and their possible impact on industry and trade.

The recommendations made can be subscribed to. In addition, specific technical assistance, capacity building and financial schemes need to be conceived and offered to enable producers in developing countries to comply with the regulations; compliance with standards and regulations requires considerable investment to upgrade design and manufacturing technologies, logistics and means of verifying and proving conformity through inspection, auditing, testing and certification.

Other elements that need further attention to fully address the impact of WEEE and RoHS on developing countries include:

- Implications of the risk that developing countries that are not producers of EEE might increasingly become "dumping grounds" for WEEE;
- Data collection on, and assessment of the impact of, trade in "second-hand, used or reconditioned" EEE; it may offer excellent business opportunities but might also hide the transfer of waste and of more polluting and less energy-efficient products to developing countries; and
- The impact and cost implications for conformity assessment to prove application of WEEE and RoHS; the problem of enforcement of any standard/directive is usually linked to the conformity assessment infrastructure and market surveillance.

Environmental requirements and barriers to trade – the experience of UNIDO

UNIDO is deeply involved in the assessment of the impact of environmental standards. It carried out pioneering work in 1995 and 1997, conducting two global surveys (implemented in cooperation with the ISO, UNCTAD and ITC) to assess the trade implications of ISO 9000, ISO 14000 and eco-labels on developing countries and on countries with economies in transition. As a result

of this work, actions in support of these countries were identified and implemented by UNIDO. The organization, as a key provider of technical assistance and capacity building in the fields of quality, standards, testing and metrology (QSTM) and sustainable environmental production, has intensified its involvement in trade matters since the establishment of the WTO Doha Development Agenda, through a holistic approach involving increased cooperation with the WTO, UNCTAD and other multilateral as well as bilateral development and technical institutions.

UNIDO has been active in the environmental field since the preparations for the Rio Conference of 1992, to which it made significant inputs. It has always worked on allying improvement in productivity and competitiveness with improvement in environmental performance. Since 1994, it has used cleaner production as the major mechanism for promoting this alliance, through the creation of the National Cleaner Production Centre programme and the establishment of such centres throughout the world. Their mission is to advance the use of cleaner production by SMEs. In recent years, the programme has been focusing more on the transfer of cleaner technologies. It is also beginning to address the issue of environmental requirements acting as barriers to market access for enterprises in developing countries.

The efforts of the EU, Japan and other countries to promulgate policies promoting extended producer responsibilities must be seen as part of a more general global trend by countries to respond to calls by the international community – e.g. in the Millennium Declaration of 2000 and at the World Summit for Sustainable Development in Johannesburg in 2002 – for more sustainable patterns of consumption and production. UNIDO is currently elaborating a long-term strategy for assisting developing countries in responding to these calls. The strategy focuses on assisting these countries in dealing with the impacts on their trade of developed countries' policies to promote sustainable consumption and production. In addition, the strategy aims at assisting developing countries also to adopt sustainable patterns of consumption and production. This connects back to the findings by UNCTAD that China and Thailand are introducing national policies for extended producer responsibilities.

With regard specifically to trade and the EEE industry, UNIDO has carried out studies on global value chains in electronics. In Malaysia, for instance, it highlights the efforts of that country's policy-makers to meet the challenges of the transition to a knowledge-intensive electronics industry, with a focus on SMEs.

WEEE, RoHS and conformity assessment

One of the problems with any new standard and technical regulation is the way exporters can prove conformity. Even if supplier (self)-declarations might become increasingly popular even among producers in developing countries, when they produce and export they still often need to go through inspection (in production, at the borders and even in the marketplace), testing, auditing and certification. Costs of conformity can be high, especially for those counties where the quality of the infrastructure for standardization and conformity assessment is weak and is not recognized internationally. Based on UNIDO needs assessments, studies and enterprise-level surveys, it can be estimated that, on average, compliance costs might reach up to 10 per cent of production costs. This shows the importance of addressing conformity issues to fully comprehend the impact of new standards and regulations.

With regard to WEE and RoHS, producers of EEE will be obliged to demonstrate compliance for their products, and it is likely that they will use a combination of self-declarations based on reports from their suppliers, plus limited analysis and testing for banned substances. Formal testing procedures or testing standards will need to be established for each of the substances, and standards on reporting formats agreed. However, it could still be unclear where the burden of proof lies within the supply chain, for example where the original manufacturer has certificates of conformance (which they share down the chain), but where later testing or use, perhaps by end users, indicates otherwise.

The conformity assessment requirements are still to be fully defined and they would be related to adoption/harmonization of the directives in the national legislative framework. Nevertheless, to test products, parts and components for RoHS compliance, when considered necessary, would require upgrading of compliance analytical laboratories, proficiency testing and inter-comparisons, and staff training. It is equally important to verify the compliance of EEE producers with the RoHS Directive; identifying and rectifying failures in new products may require lengthy development work before the 1 July 2006 RoHS deadline

As reported in the chapter, it appears that Thailand is addressing the compliance problem through its establishment of a Trace Element Analysis Lab (TEA-Lab). It would be interesting to study what is being done in other countries and describe the specific technical assistance programmes under way to make testing requirements cost-effective and reliable.

Access to information and knowledge: early warnings

Countries establish appropriate notification mechanisms as part of their membership of WTO, to allow governments and their operators to be informed about new standards, technical regulations and conformity assessment procedures. Evidence to date strongly suggests that the system needs improvements, including complementary actions to allow information to effectively reach industry, consumers and regulators. Even when information reaches actors that would be affected by a new regulation, it would still be necessary to assess its impacts to enable producers to identify feasible means of adapting products and production methods to new requirements, and to upgrade conformity assessment procedures and institutions. This would be needed in order to enhance market access opportunities and avoid the risk of the regulation becoming a new barrier to trade.

The creation of early warning mechanisms/export alert systems would help developing countries overcome possible technical barriers to trade. We believe that for these systems to be effective, in addition to performing an information dissemination function, there is a need for them to develop and improve their capability to assess the impacts on production systems and the costs of compliance (e.g. inspection, auditing, testing certification, accreditation). Also, they need to offer practical and financially feasible solutions to overcome potential or actual barriers to trade. Furthermore, we recommend the inclusion of technical assistance components to help SMEs upgrade their production processes and products to comply with new technical regulations, standards or conformity assessment procedures of the importing countries.

The E-TRACE project in Egypt is an example of UNIDO's approach to early warning and to assisting producers overcome possible TBTs as well as improving supply chain management. This is a trade-related technical assistance and capacity-building (TRTA/CB) project (funded by utilizing a debt swap agreed between Italy and Egypt) through which producers and public institutions are being assisted, both technically and financially, in their efforts to meet the requirements of the EU market set by the EU regulation 178/2002. This regulation lays down the principles on food safety and circulation, with explicit reference to traceability of food products.

Initially, UNIDO and the Egyptian Ministry of Foreign Trade assessed the possible impact of and the business opportunities for Egyptian exporters of the new EU regulation. It then carried out an awareness-raising campaign and identified possible cost-effective solutions, taking into account the export data and the local capabilities and resources. At this point, a project was developed to provide institutional capacity building and technical assistance, and to create a financial facility for the purpose of providing access to funding for those producers that decided to implement food traceability systems and upgrade their skills and capabilities. The model is proving to be very effective and could easily be duplicated in other countries for addressing other new standards and technical regulations in the environmental and other fields.

Another example in relation to TBTs arising from environmental standards such as the take-back policies for EEE, is a project in India where UNIDO is promoting the transfer of cleaner

technologies through the Indian Cleaner Production Centre and its partners. The project focuses on two sectors, one of these being the automotive components sector. This is a large and growing sector in India, which is coming under pressure from environmental policies such as the EU's End-of-Life Vehicles Directive (which, like the WEEE Directive, is based on the principle of extended producer responsibility). Companies in the sector envisage that, because of the Directive, their clients (the automobile manufacturers) will soon be requiring their component suppliers to eliminate the use of hexavalent chromium. They have therefore approached the Indian Cleaner Production Centre within the context of UNIDO's cleaner technologies promotion project, to request assistance in finding alternative processes that do not use this chemical. Similarly, the Ugandan Cleaner Production Centre has been working with a client that exports flowers to the EU, to redesign the packaging it uses so that, among other things, it is easier to recycle within the context of the EU's Directive on packaging (yet another Directive based on the principle of extended producer responsibility).

Concluding remarks

Creating awareness and building capacity to deal with environmental standards and other emerging technical regulations or conformity assessment procedures not only reduces possible barriers to trade. It can also transform a potential technical barrier into a trade opportunity for those entrepreneurs in developing countries who exploit the chance the new directives offer by being the first to adapt to the new "rules of the game". By moving faster than its competitors in making the necessary investments, an enterprise can be rapidly in compliance with the importers' new restrictions, which in turn allow it to appropriate a larger market share and possibly become the new market leader.[1]

Finally, the cost implications for ensuring conformity and market surveillance for WEEE and RoHS need to be further studied. In addition, the possibility of developing specific technical assistance projects that could be jointly implemented by UNIDO, UNCTAD and other institutions should be explored. The Consultative Task Force on Environmental Requirements and Market Access for Developing Countries could well offer the opportunity to move from assessment to concerted action to help developing countries implement environmental standards and regulations such as WEEE and RoHS.

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Where ethics meets practice

In analysing the impact and opportunities arising from the transnationalization of environmental requirements for end-of-life electrical and electronic equipment exported by three rapidly industrializing countries in Asia, the paper by Vossenaar, Santucci and Ramungul also touches upon the fastest growing global waste stream – EEE waste. Given its constituents and characteristics, this waste stream could be subject to the Basel Convention's control regime, which increasingly takes centre stage in international discussions on environmentally sound management of such waste.

On a more general note, economic action and intelligence move faster than environmental action and intelligence. In today's world, globalization of the world economy sets the tone. Globalization brings successes and failures. Those benefiting from global trade may not be the ones enduring its resulting undesirable health and environmental effects. Globalization generates both benefits and problems. As a consequence, multilateral environmental agreements (MEAs), like the Basel Convention, have to react to mitigate these problems. Environmental action too often remains reactive and compensatory. However, the proper use of an MEA like the Basel Convention can be an effective preventive instrument.

The massive influx of EEE wastes to industrializing and developing countries generates income and creates jobs in these countries. Although economic prosperity is on the rise, those exporting and importing EEE wastes may not want the headache of solving the associated problems. Why is that? First, because there is no level playing field but there are a lot of free riders in the EEE waste business. Second, because governments have been taken by surprise and need time to adjust to the fastest growing waste streams in the world. There are no assurances that with economic advancement those countries that import EEE wastes will necessarily address the acute and long-lasting negative health and environmental effects of such wastes.

So which is the way forward? In the spirit, intent and purpose of the Basel Convention, every country needs to establish and operate effective control over the import of EEE wastes. Every country has a sovereign right to know and decide on what it can process and what it cannot process. Unless such a control is in place and enforced, the massive influx of uncontrolled EEE wastes to developing countries will continue to generate an ever-growing health and environmental burden for these countries. Similarly, such measures would be expected of the exporting countries.

Economic prosperity and the environmentally sound management of wastes, end-of-life equipment or post-consumer goods have to be accessible to everyone, everywhere and all the time. But if economic prosperity goes without environmentally sound management, we will pass on a legacy of a limping world to our children.

Electronic and electrical wastes, if they are not cleaned of their hazardous substances or components, can be controlled under the Basel Convention if subject to transboundary movements. To name such wastes differently, like post-consumer goods or end-of-life equipment, will not remove their hazardous constituents but may create confusion and uncertainties. A waste is classified and characterized as hazardous waste in the Convention because of its intrinsic hazards or properties, irrespective of whether such waste is destined for recycling, recovery or final disposal.

The sound management of EEE wastes requires adherence to national, regional and international legal regimes, a conscious decision to apply the principle of producer responsibility, a commitment to cooperation among countries to build capacity for sound recycling and recovery, as well as the disposal of residues arising from these operations, and reliance on a coherent set of interrelated and mutually supportive policy directions, including hazardous waste minimization, a

life-cycle approach to chemicals and integrated waste management. In this regard, the chapter describes the proactive environmental measures taken, in particular by China and Thailand, to adjust to the increasing volumes and complexities of EEE wastes generated domestically or imported.

The world is split apart. Industrialized countries have put in place strong environmental policies for the prevention, reuse, recycling and recovery of EEE wastes, whereas such drastic preventive and protective measures do not exist in many countries to which large volumes of such wastes are being exported. Is such a split world sustainable? Globalization is also about providing an equitable share of wealth.

The spirit of the Basel Convention simply recognizes that wastes are not ordinary substances or materials, and, when hazardous, represent a serious immediate or long-term threat to human health and the environment. The Basel Convention is about the global issue of the sound management and minimization of hazardous and other wastes and its universal application. The Convention is part and parcel of the international architecture required for ensuring that the globalization of EEE wastes does not lead to unprecedented harmful effects of post-consumer goods or end-of-life equipment on human health and the environment. Waste avoidance is a key factor in progressing towards alleviating the burden on importing countries. Improving the capacity for the sound reuse, refurbishing or recycling and recovery of EEE wastes in importing countries will improve health and environmental protection and generate economic benefits. But all this needs a commitment by all responsible stakeholders to bear their share of the burden and to marginalize unscrupulous economic actors – an ethical project for the benefit of all.

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Vossenaar et al.'s paper on the Electrical and Electronics sector provides a thorough examination of an issue of particular importance for the Asia-Pacific region. As the study establishes, four countries of the region – China, Malaysia, the Philippines and Thailand supply over 50 per cent of the value of developed-country imports of electrical and electronic equipment (EEE). It is also important to note that the environmental implications of the EE sector in Asia and the Pacific are compounded by two other trends: the rise in domestic consumption of EE products as the Asian economies grow, and the volume of EE wastes that reach their end destination in Asia, both from domestic sources and developed-country waste streams.

In that regard, the sector is illustrative of the complexity of trade and environment issues for developing countries in Asia and the Pacific. While these issues have been frequently analysed in terms of the environmental requirements for exports of products from developing countries to developed-country markets, the EE goods sector illustrates that the more complete picture often concerns the environmental implications of both international and domestic trade flows.

The Asia-Pacific region is experiencing the fastest economic growth of any region in the world. This growth has contributed to significant and increasing environmental pressures, with serious consequences for the environment, human health and well-being, and long-term economic prosperity. The region is home to over half the world's population, including two thirds of the world's poor. Sustainability is thus not only important for the region itself, but also in terms of its impact on the sustainability of the world as a whole. There is a growing need to ensure economic development, in part through maximizing opportunities for market access to external markets, but it is also important to ensure that this access does not undermine domestic environmental sustainability.

An integrated approach to trade flows of developing countries

The trade and environment issues of concern to developing countries in Asia and the Pacific, and in fact worldwide, can be divided into two categories. The first concerns issues associated with developing countries' exports and production of goods for export. The second concerns issues associated with developing countries' imports and their production for domestic markets. Frequently, goods produced in developing countries do not adhere to the product standards, and process and production methods imposed by developed countries. This creates two costs for developing countries: (i) the potential economic gains of greater market access to developed-country markets are lost; and (ii) developing countries have to absorb the cost of environmentally unsustainable and hazardous process and production methods.

The import of products into developing countries can also have distinct environmental impacts, specifically: (i) developing countries' imports of products that would not be accepted in developed countries such as second-hand waste, hazardous materials and low quality products can have a negative impact on the environment and human health; and (iii) the import of certain types of products can have a negative impact on environmental sustainability in developing countries, including through their impact on consumption patterns.

Frequent technological improvements in the EE sector that encourage "upgrades" have created a stream of waste, the volume of which is increasing throughout the world. As UNCTAD's analysis clearly points out, regulations in the industrialized world, including the EU, Japan and the United States, have addressed the sustainability of the electronic sector, creating production requirements and designating responsibility for waste collection and management. These regulations have significant ramifications for a number of countries in Asia that have sizeable imports, exports, or both, of EE products.

Developing countries in the region need to enhance their access to external markets by meeting the environmental requirements of importing countries, while at the same time instituting domestic policies to control local consumption, encourage clean production and ensure appropriate recycling, reuse and safe disposal (including through import controls on hazardous electronic waste, such as through implementation of the Basel Convention, as discussed in the chapter). This would contribute to the economic growth necessary to eradicate poverty in the region while minimizing the transfer of environmental costs from developed to developing countries. To achieve these goals, however, many developing countries have indicated their need for further capacity building and technical assistance, including from other developing countries that have begun to enhance their own market access capabilities. The challenge, especially for SMEs, remains great.

UNCTAD's ongoing response to this need through its capacity-building workshops in the region has been well received. In addition to the work of UNCTAD, ESCAP, as part of a joint project of four United Nations Regional Commissions, is undertaking capacity-building activities in Asia and the Pacific on a subregional and sectoral basis throughout 2005 and 2006. However, capacity building is only part of the solution. UNCTAD's analysis makes two other pertinent observations about the realities of adjustment in the region. Many of these observations are equally applicable to experiences in other sectors and regions. The first underscores the need for consultation with and the involvement of developing countries in the development of legislation that affects them. Such involvement would assist legislators in setting time frames for implementation that would better enable developing countries to prepare for environmental requirements in a timely manner. The second concerns the need for more systematic dissemination of information and tools to enable enterprises, and especially SMEs, to adjust their production and other processes so that they do not lose market access. The current variability in adjustment processes of the countries studied demonstrates that a planned, multi-stakeholder approach to adjustment is appropriate and effective.

In addition to supporting a more inclusive development of environmental requirements and systematic, multi-stakeholder adjustment processes, ESCAP as a regional organization notes the recommendations for further exploration of adjustment tools that could be provided at a regional level. It looks forward to further exploring these possibilities with other agencies through its membership of the Consultative Task Force (CTF) on Environmental Requirements and Market Access. The CTF, although newly established, should be a valuable mechanism for assisting agencies in avoiding duplication, planning activities strategically for maximum coverage and impact, and supporting the development and sharing of analysis needed by developing countries. ESCAP looks forward to being an active member of the Task Force.

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In only a few decades, electrical and electronic equipment (EEE) has become ubiquitous in the homes and offices of the industrialized and rapidly industrializing world. However, the environmental implications of EEE have not yet been subjected to similar levels of consideration and debate as their economic and social aspects. As with any major technical revolution, the effects of, for example, information technologies as one of the 10 EEE product categories specified in the WEEE Directive are significant and wide ranging. Examples include increases in environmental efficiency in products and services, and shifts in transport, trade and consumption patterns associated with the increasing use of e-commerce and telecommuting. But there are also direct environmental implications associated with EEE due to the impact of production, use and disposal of the equipment.

Concerns over the environmental and health problems associated with EEE have prompted policy initiatives at both governmental and industrial levels, most notably the WEEE and RoHS Directives of the EU and the HARL and Green Purchasing Law of Japan. But in addition, political incentives will be required to achieve any real innovations for managing the environmental impact of EEE in a sustainable way, as well as for closing the digital divide and maintaining market potential and access for all countries involved in the largely globalized supply chain. The chapter by Vossenaar, Santucci and Ramungul addresses the latter issue, which has been dealt with only in passing, if ever, in the political and scientific discussions about environmental regulations for EEE. It discusses environmental requirements and market access for the rapidly industrializing countries of China, the Philippines and Thailand, and recognizes the need to promote sound collection and management of EEE waste in these countries.

The paper discusses with clarity the issue of transmission of environmental standards set in key markets such as the EU and Japan, which involves all exporting producers through largely globalized trade and supply chains. This is of special importance for the newly industrializing countries in South-East Asia, which were responsible for approximately 75 per cent of the value of EEE-related world trade in 2002. The paper is coherent, logical and well documented, and an important contribution to the discussions on the development impacts of EEE through regulatory and other policy instruments that attempt to reduce the environmental load of this booming sector. It is difficult not to share most of its conclusions and recommendations: this commentary also advocates joint efforts of all actors along the largely global supply chain of EEE.

Increasing attempts in the EU, Japan, Switzerland and elsewhere to apply the principle of producer responsibility also in the EEE sector point to a growing problem that deeply affects the rapidly industrializing countries in South-East Asia. This is for two key domestic reasons that are complementary and elementary, in addition to those expressed in the chapter: the growing markets for EEE in their countries of origin, and the environmental and health impacts of EEE, even in the production phase.

The direct environmental implications associated with EEE stem from the impacts of production, use and disposal of the equipment itself. This is an issue of consequence, especially given the huge number of rather complex EEE, such as personal computers (PCs), in homes and offices in the industrialized or post-industrialized world. In April 2002, the billionth PC was shipped and global annual production is still around 130 million. PC penetration rates in the industrialized countries are high, and it is plausible that the number of PCs could increase to one or more per capita in these countries. Meanwhile, there is also rapid growth in PC and other EEE use in much of the rapidly industrializing countries. China has become the world's biggest consumers of refrigerators. Consequently it is likely that the production rates to satisfy domestic demand alone in countries such as China, the Philippines and Thailand will grow significantly over the next few

years. And this will be in addition to production for export, provided these countries succeed in making the necessary timely adjustments to external environmental requirements.

As with most developments, the benefits are also accompanied by certain risks, especially when the countries are simultaneously key producers for the global market and have a booming domestic market, which leads to growing mountains of obsolete machines. In addition, several of the rapidly industrializing countries are also international hubs for outdated EEE, mainly for materials recycling purposes. The internal structure of the PC is complex, making recycling difficult. Yet many of the machines are still either usable or contain usable components, creating a real challenge for end-of-life processing. As a result of comprehensive new legislation, which has been introduced in, for example, the EU and Japan, as described in the paper by Vossenaar et al., firms are obliged to include waste management considerations, such as the use of easily recyclable and recoverable materials and the control of hazardous substances, into design and production. But, although the environmental impacts of lead and mercury have been considerably analysed for various product groups such as tubes and batteries, this knowledge has yet to be applied to assess the risks associated with heavy metals in electronics and, especially, IT equipment. Thus there is no substantive basis to justify the decision of the EU to ban these substances; its policy formulation is made on assumptions, leaving considerable scope for uncertainty among consumers, producers and employees.

Nevertheless, the complexity implies that the production of PCs and their components will remain rather material- and energy-intensive. A recent study of the UNU has shown that for producing only a 2-gram memory chip, 1.3 kilograms of fossil fuels and chemicals are required. Yet the use of fossil fuels is already closely correlated with impacts on climate change. Efforts have been made to reduce the environmental impacts through chemical substitution, reduction of use, and improved treatment and storage technologies in the manufacture of semiconductors. However, there is very little information available regarding environmental practices in countries such as China and the Philippines. The health of workers involved in chip fabrication is of particular concern due to their long-term exposure to chemicals, which might result in increasing rates of birth defects and cancer – an issue in which firms and governments have shown little interest, despite a barrage of lawsuits of former workers in countries such as the United States.

To make one desktop PC with a 17-inch CRT monitor, about 22 kilograms of chemicals, 240 kilograms of fossil fuels (05,040 mega-joules) and 1,500 litres of water are used, along with a significant amount of energy compared with other consumer goods. An automobile or refrigerator requires around 2,000 kilograms and 50 kilograms, respectively, of fossil fuels in production. The ratio of embodied fossil fuels to product weight for a computer is nine times, but only one or two times for an automobile or refrigerator. The typical PC has an average life span of three years in the industrialized and post-industrialized world, which makes this high amount of energy in production even more noteworthy. Office equipment consumes about 3 per cent of energy requirements in the United States, more than 40 per cent of which can be attributed to the operation of PCs; and there are similar estimates for other regions of the world. But energy-efficient technologies and strategies in the commercial sector are helping to reduce the environmental impact such as from greenhouse gas emissions. Nevertheless, PC energy requirements are expected to increase, due to PCs being kept on even when not in use (e.g. overnight) and due to the growing rate of utilization of computers.

This short description of a life cycle of a computer and its components illustrates the extent to which countries such as China, the Philippines and Thailand have to respond substantially through appropriate countermeasures, not only to meet certain environmental standards set by the main recipients of their EEE products, but also to fight a risky development in their own countries. Thus, in addition to the recommendations made by Vossenaar et al., one should also call for greater efforts to develop regulations for the production and consumption phases in these countries. Setting recycling and related eco-design requirements throughout the supply chain will certainly help

encourage the key exporters of EEE to consider appropriate adjustment strategies that go beyond mere market-led adaptation. Considerations of national WEEE management strategies, including the extension of a product's life span through reuse and repair, are already under way in countries such as China and Thailand.

However, there is a lack of public awareness of the environmental impacts from the production of EEE in both the industrializing and industrialized countries. Consequently there is almost no demand for environmentally sound EEE that could stimulate an industrial response. It would therefore be effective and efficient to combine efforts at an adjustment to external requirements of exported EEE with efforts towards an adjustment to internal requirements for sound WEEE collection and management, as suggested by Vossenaar et al. But these should also be combined with a campaign informing the public about the environmental impacts of EEE and appropriate ways to manage and reduce them. Such a campaign could push for an extension of EEE's life, for a reduction of harmful effects during production and of energy consumption during use, as well as the reduction of material inputs. But there are political decisions that often lead to rather absurd results from the perspective of sustainability, which require correction. One example is taxation of office equipment, including PCs, in Germany that discriminates against the utilization of refurbished PCs and therefore artificially shortens the life span of computers.

There is therefore a need not only for exchanging national experiences in developing adequate collection, repair and recycling systems, and exploring options for subregional cooperation, as suggested by Vossenaar et al., but also for discussions on harmonized global action that takes into account the entire life cycle of EEE. Actions are required at the level of the international community, governments, civil society (including academia) and the business sector, not only to enhance understanding of trends in environmental requirements and appropriate adjustment policies, but also to develop a common approach to successfully address the growing problems created by EEE. A careful analysis of the present situation with regard to the production, consumption and final disposal of EEE in the rapidly industrializing countries and an open exchange of experiences and ideas would help guide the way to possible problem-solving strategies. UNCTAD's CTF can play a useful role in promoting these dialogues, if accompanied by appropriate assessments and empirical analyses to provide a solid basis.

A joint consortium of UNU, Hewlett Packard and Promotionteam Wetzlar is initiating a new project entitled Solving the E-Waste Problem (StEP). It aims at building a network of stakeholders from industry, academia, international organizations and NGOs to conduct research, dissemination and capacity-building activities. The group is to collaborate, through a common understanding of its objectives, to enhance reverse supply chains for EEE, with a view to:

- Mitigating environmental harm from EEE-waste processing in the industrializing world;
- Promoting efficient use of resources and increasing reuse of equipment, when appropriate; and
- Improving economic and social development, particularly in the industrializing world.

UNCTAD's experiences, expertise and continuing efforts, such as those on adjustment policies, and the exchange of national experiences through projects such as the UNCTAD/FIELD project and the CTF, makes that organization not only a valuable partner for the "StEP" endeavour, but also gives many opportunities for synergies between the activities of UNCTAD and StEP in the challenging field of EEE.

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This chapter by Vossenaar et al. clearly highlights the environmental concerns resulting from the growing amount of post-consumer waste generated by the electrical and electronics (EE) sector, as well as the risks that hazardous materials used in the production may pose at the end-of-product life, including for recovery or recycling. More importantly, it emphasizes the need for concrete lines of action to control and reduce the waste and, better still, to prevent it.

Today, developed countries are taking a lead in this area. The EU is driving the process through the WEEE and RoHS Directives and other countries have new legislation imposing similar requirements. Transnational corporations (TNCs), which have factories located all over the world, have been working towards a solution for the removal of lead and heavy metals content, or already have one. This is the case, for example, of Intel, which has its assembly and test factories in China, Costa Rica, Malaysia, and the Philippines, as well as other companies such as Motorola, Agilent and Sony.

Malaysia has been relatively less affected by the new requirements for at least two reasons. First, the TNCs operating in Malaysia have been preparing to meet the requirements through direct communication between their head offices and their respective subsidiaries in there. Second, non-TNCs are manufacturing EE goods largely for the domestic market, under their own brands. Even when they become local suppliers of TNCs, they are generally in a position to get the necessary technical support from the TNCs they supply, for example, through mentor programmes. In the context of ISO 14001 certification programmes, TNCs, as mentors, enlarge their "sphere of influence" to the operations of their respective local suppliers and assist them in obtaining certification. Certain TNCs, such as Sony Electronics in Penang, have also created partnership programmes with local suppliers to reduce the global environmental impact of their products and promote proper upstream management of the use of substances.[3] Apart from the large number of ISO 14001 certified companies, the relatively high degree of environmental awareness of the EE industry in Malaysia is also reflected, for instance, in their environmental reporting (including the publication of environmental performance indicators).[4]

The TNCs in the EE sector in Malaysia produce mainly semiconductor components, optical products and LAN (local area network) communications. TNCs providing electronic manufacturing services produce, among other things, motherboards and networking cards. Those specialized in consumer products manufacture mainly TVs and CD/DVD players. The TNCs subcontract their production to local SMEs to supplement their production when their own capacity is limited, or they outsource the production of more traditional products when they diversify into new products. Some TNCs also subcontract some of their process steps like burning in their boards or components, or for the final packing process. Some of the other areas where local SMEs support the TNCs include supplying automation solutions, jigs and fixtures to improve productivity and reduce costs of the operations. As mentioned earlier, most Malaysian brands, especially consumer EE goods such as Pensonic and Khind, are produced for the domestic market.

This poses a few challenges including the issue of who should be responsible for providing the solutions to their suppliers and subcontractors. For large companies, there is no major problem as they have the competence and resources to find ways of removing hazardous materials used in

their processes or components. However, since this can be a costly process, SMEs that have neither the resources nor the expertise to find solutions obviously need assistance. In Malaysia, it is widely believed that SMEs will be the most affected, as the additional costs will have an impact on their competitiveness.

The electronics industry is the leader in Malaysia's manufacturing sector, contributing substantially to the economy.[5] In 2003, its structure was as follows: 68 per cent for electronic components, 19 per cent for consumer electronics and 13 per cent for industrial electronics. The total value of electronics exports from Malaysia in 2003 was about $52 billion (accounting for 52 per cent of total exports), the largest being electronic components ($25 billion), followed by industrial electronics ($22 billion), and consumer electronics ($5 billion). The industry employs 360,000 persons, representing 36 per cent of total employment in 2003. The presence of TNCs in Malaysia has created a sizeable local market for components and supporting or ancillary industries. There is now a strong network of inter- and intra-industry linkages in the sector. Since the inception of the Industrial Linkage Programme in 1997, a total of 170 SMEs have forged linkages with TNCs and other larger local companies. Most of the SMEs are involved in electronics, machinery, fabricated metal products and engineering support services. Some are also established to serve the EE industry for plastic injection moulding, metal stamping, machining, electroplating, moulds, tools and dies, and manufacture of electronic components.

Legislation, the voluntary application of elements of the concept of producer responsibility, as well as the use of the ISO 14000 and 18000 series of standards, have prompted certain companies to incorporate environmental, health and safety (EHS) requirements at the early design stage, for both products and processes. Sony Electronics (Malaysia) Sdn Bhd, for instance, has started its own product design for the environment since 1999 by carrying out new product life cycle assessment based on the ISO 14040 series of standards.

The use of environmental management systems, such as ISO 14001, may bring benefits to companies and help to increase market share. Studies on the European experience (see, for example, Hillary, 2000) show that cost savings to the producers, a better corporate image and improved employee morale are among the major benefits. However, environment-friendly products and services have yet to find their market niche, as revealed by a survey in 2000 of the Malaysian Institute of Management (*The Star,* 17 December, 2000). Environment-friendly products and services as a factor in gaining a competitive edge has been found to be the least important of all factors, including customer-related as well as other product-related ones such as price, quality, reliability, technical excellence, advancement in design and product reputation. To create a win-win situation there should be shared responsibilities between producers and consumers. Producers should be made responsible for producing goods containing some recyclables, and consumers should be made accountable for sorting and returning their post-consumption products to the collectors of recyclables and non-recyclables.

In general, the chapter adequately addresses the concerns of developing countries and provides some ideas on how to respond to them. However, in addition, more specific actions are needed to mitigate the problems relating to the lack of awareness, poor management of information, inadequate exchange of information, and lack of openness in communication among all stakeholders. All these problems can lead to reactive (rather than proactive) and sluggish industrial restructuring and adjustments in developing economies, as well as to "new" investment (and unnecessary financial commitment) in out-of-date products and processes. There is a need for more direct communication on new environmental requirements between developed and developing countries. For example, regulatory agencies on FDI, such as the Malaysian Industrial Development Authority and the State Economic Development Corporations, as well as national environment regulatory authorities, such as the Department of Environment of Malaysia, should be informed by their developed-country counterparts about new policy develop-

ments. They should be in direct communication with them with a view to anticipating future requirements and assisting industries in adapting to them.

General "waste and sewage" was among the problems experienced by Europe from the 18th to the mid-20th century. However, these problems have yet to be satisfactorily addressed and overcome in numerous developing countries, including Malaysia. Malaysia's goal is to recycle 22 per cent of total waste by the year 2020. Currently, only 3 per cent is recycled. To achieve such a target, Malaysia has prepared a Solid Waste Master Plan, and has been debating a Solid Waste Management Bill that has yet to be passed by Parliament. In the meantime, Malaysian local authorities, led by the Ministry of Housing and Local Government, are undertaking numerous steps and activities to increase public awareness of recycling. However, there is neither a clear nor a specific policy to deal with post-consumer EEE waste.

E-waste management is certainly an issue of concern in Malaysia, and some legislation does exist to address some industrial waste issues. Those industrial waste types considered largely "toxic and hazardous", or not generally accepted at the sanitary landfills managed by the local authorities, are defined and listed as "scheduled wastes" in the Regulations of 1989 under the Environmental Quality Act 1974 (Amendment). The specific types of e-waste covered by the Regulations are discarded electrical equipment or parts containing or contaminated with polychlorinated biphenyls (PCB) or polytriphenyls (PCT). Amendments have been proposed to also include waste electrical and electronic assemblies containing components such as accumulators, mercury switches, glass from cathode ray tubes and other activated glass or PCB capacitors, or those contaminated with cadmium, mercury, lead or PCB.

Among the industrial sectors, the EE industry is the third largest generator of scheduled wastes after the metals and chemicals industries (Malaysia, Department of the Environment, *Environmental Quality Report*, 2001). Several TNCs have been working towards reducing production waste. Sony (Malaysia), for example, has established a target to reduce the volume of hazardous wastes generated by its production activities by 10 per cent per year, and is working towards zero waste emission (recycling over 95 per cent of the volume of waste) (Sony Electronics (Malaysia), 2003).

Malaysia has some state-of-the-art waste treatment facilities. The Kualiti Alam industrial waste treatment facility was awarded a 15-year exclusive contract to handle Peninsular Malaysia's scheduled waste on a commercial basis in 1995. But the facility is facing capacity constraints, and is not updating its schedule of fees, which are generally considered quite high. The industry has complained about high waste disposal costs. As a result, a number of industries such as the national automakers, PROTON and PERODUA, have invested in their own waste treatment facilities; over 77 licences have been issued to the operators of scheduled waste collection, recovery and recycling facilities. The only licences for final treatment and disposal of scheduled waste have been issued to Kualiti Alam and Trienekens (the only two concessionaires for the final treatment of all types of scheduled waste generated in Peninsular Malaysia and in the state of Sarawak respectively), and to five specific waste concessionaires, Faber Medi-Serve, Pantai Medivest, Radicare and Normah Medical Specialist Centre, for the final treatment of non-radioactive clinical and infectious waste, at 14 different facilities in various regions or states, and to Petrojadi for the conversion of oily sludge and waste-to-energy in the state of Sabah (www.jas.sains.my/hazardous substances). The Atomic Energy Licensing Board regulates used radioisotopes and other radioactive wastes, which are treated at the facility of the Malaysian Institute for Nuclear Technology in the state of Selangor (www.mint.gov.my). Citiraya of Malacca, is a newly established company to process and treat e-waste generated by the electrical, electronic and telecommunications industries in Malaysia.

Other than for final treatment of the special types of waste, and for some limited resource recovery, little progress has been made in dealing with post-consumer EEE waste from the 5R

perspective: reduce, reuse, recycle, recover and reposit (for future use). In the state of Penang, for example, most of the EEE waste generated by households and small businesses ends up in landfills, as there is currently no mechanism for recycling or for safe disposal of community-generated EEE waste (Socio-Economic and Environmental Research Institute, 2003). The informal sector buys e–waste for a minimal price and sells it to customers looking for spare parts, either for repair work, for refurbishing computers for reuse, or for export to China; but it does not dismantle or recycle e-waste in an environmentally proper manner. Larger operations also exist and receive e-waste stocks from factories. Vendors are engaged to scrap such items and not sell them as second-hand products.

Some larger companies have initiated well-organized programmes to collect computers from the community for refurbishment and resale. For example, in February 2004 Dell, in cooperation with the Government of Penang state, launched a voluntary PC Recycling Programme to collect e-waste at zero cost.

Apart from other wastes, today, developing countries also have to handle the additional burden of post-consumer EEE waste. This will be a huge problem unless the principles of "producer-responsibility" and "consumer-accountability" are put in place and widely practised. Perhaps the producers should help finance the collection and recycling centres, while the consumers bear the costs of transporting their used goods to such centres. Otherwise, the costs of collection, cleaning and disposal of the unwanted materials have to be borne by local authorities, and thus, the general taxpayers.

With regard to *consumer responsibility*, the lead author of this commentary has proposed that the *indifferent-consumer-pays* principle be introduced as an environment-economic policy instrument in national waste management, based on the 3Rs programme, which can be extended to 5Rs (see above). Consumers would be responsible for depositing unwanted materials into material-specific recycling bins, as the costs of waste collection and sorting are generally very high (recycling in the informal sector may be less expensive, but involves environmental risks). The producers can gain in competitiveness by introducing new and increasingly environment-friendly products and services, as the recyclables become more accessible and readily available not in the backyard but in the open market, through a nationally organized "exchange of recyclables", similar to those for any other commodities. It is too early to assess the experience of Malaysia in promoting the "indifferent-consumer-pays" principle. It is currently being reviewed by the relevant authorities of Malaysia in connection with the policy statement relating to waste management as contained in the 3rd Outline Perspective Plan of Malaysia (1996-2005) and elaborated in the 8th Malaysia Plan (2001-2005).

The following are a few recommendations for consideration (some of which are already discussed by Vossenaar et al.):

- TNCs are well informed of various environmental requirements, but SMEs still do not fully understand their implications. There is a need to create timely programmes to generate greater awareness of any proposed requirements and their implications;
- There should be a centre or forum for SMEs to discuss and identify possible solutions. Better still, all countries should collaborate and share information, either on the Internet or through universities or research centres, to assist SMEs;
- ISO 14001 should be used to increase awareness, and companies should be motivated to become 14001 certified. This will help in promoting the 5R programmes;
- The costs of certification need to be reduced to allow more SMEs to become certified;
- Addressing issues, such as eliminating the use of hazardous materials, during the design stage is the right approach. One way to encourage companies, including SMEs, to do this is to provide some incentives such as a tax reduction or grants;
- There is a need to create collection centres for consumers to return their end-of-life products as well as facilities to dispose of such products in an environmentally sound manner.

Many TNCs located in Asia have already started to introduce elements of producer responsibility. Collection centres are being set up in countries such as Malaysia and Singapore to collect used or discarded products so that they can be disposed of properly. Most of these companies pay the costs of transportation, and some even give rebates if their products are returned to their centres. In Malaysia, this is mainly driven by TNCs; local companies should be encouraged to follow their examples;

- Greater efforts are needed to promote more and effective participation from developing countries in the development of policies and legislation to protect the environment, in particular in the EE sector; and
- Capacity-building programmes should respond to the pressing need for a closer rapport and more open communication at the national, regional and international levels between all relevant authorities, particularly in the areas of environment, industry and trade. This was organized for industries of developing economies when they were required to conform to national obligations under the Montreal Protocol on Substances that Deplete the Ozone Layer of 1987.

UNCTAD's Consultative Task Force (CTF) can play a useful role in facilitating the exchange of national experiences among the key EE exporting countries, in particular those in Asia, and in identifying opportunities for cooperative subregional approaches. CTF activities are moving in the right direction by adopting a more proactive, anticipatory approach, including proper information management, participation in pre-standard/regulation-setting stakeholder consultations and the forming of public-private partnerships.

Federation of Industries of the State of São Paulo (FIESP), Brazil

About the chapter and the issue

The paper by Vossenaar et al. offers a broad and necessary overview of the issues involving environmental requirements related to the EEE sector. It confirms the noticeable trend towards the proliferation of regulations and standards, and its effects in terms of potential loss of market access for developing countries. It also sheds light on the greater challenge posed by environmental and health standards and regulations, which have grown significantly over the last 15 years along with increased international commitments as embodied in multilateral environmental agreements (MEAs) in areas such as biodiversity, climate change, restriction on the use of hazardous substances and toxic waste.

Brazil is a developing country that conducts foreign trade with major world markets – those of the United States, the EU, South-East Asia (including Japan) and Latin America. It is also geographically large with biodiversity assets that make it a strong supporter of MEAs. It therefore has a vested interest in achieving a proper balance between commitments in the fields of environment and health protection on the one hand, and market access for goods produced in developing countries on the other. Therefore its private sector is constantly under pressure both to achieve global goals – set by Brazil and other countries – and to respond to changing patterns of consumption in its major export markets resulting from preferences for environment-friendly goods. Furthermore, Brazil also faces protectionist practices in sectors that have become aware of the potential of "environmental non-tariff barriers" to block market access of competitive developing countries' industries.

A previous background note elaborated by UNCTAD and presented at a pre-UNCTAD XI event here in Brazil, during the inception phase of the Consultative Task Force (CTF), already demonstrated the need for more interaction on policy issues and capacity constraints between three levels: the World Trade Organization (WTO), the international level outside the WTO and the national level in developing countries. It is particularly important for developing countries, which have significant capacity constraints, that efforts to link policy and capacity issues receive greater attention under the umbrella of the WTO. This is reinforced by the fact that the WTO offers a much broader policy discussion space than other Bretton Woods institutions due to its decision-making process based on the consensus rule.

At the same time, owing to the very nature of opportunities or constraints resulting from commitments in the WTO, developing countries tend to focus their scarce resources in this arena rather than in activities of other international organizations dealing with standards harmonization. This is as true for small economies as it is for a developing country such as Brazil. And it is also true in the sense that the private sector has significantly fewer resources than its government counterpart to assess the impact of new regulations and to design effective adjustment policies. However, many developing countries face significant capacity constraints, including a lack of human resources, that prevent them from making full use of WTO disciplines and TBT and SPS inquiry points. Also, little systematic attention is being paid to analysing the impact of voluntary environmental requirements that are increasingly present in international markets, and to the design of effective adjustment policies in this regard.

The Brazilian manufacturing sector has already initiated a series of initiatives at the national and state-level, related to the issues of WEEE and RoHS Directives as well as to general environment protection concerns.

The experiences of FIESP

The Environment and Sustainable Development Department (DMA) of FIESP coordinates all initiatives in this field, and has focused its actions on five major industry-related environmental

themes: environmental management, environmental licensing, pollution prevention and control, water resources and industrial waste. These are complemented by a strategic "environmental conformity" agenda composed of four integrated phases:

- Compliance: designed to help industries meet environmental requirements established by legislative action (regulations);
- Normative conformity: designed to help industries in voluntarily meeting environmental requirements established by standards;
- Eco-efficiency: designed to help industries adopt processes and production methods (PPMs) in conformity with environmental requirements, bearing in mind the environmental impact and costs, as well as the principle of continual improvement of environmental performance; and
- Eco-business: designed to help industries in accessing markets with responsible consumption patterns based on environmental criteria.

Regarding the issue of environmental requirements and their impact on market access for developing countries, the DMA has three types of initiatives, discussed below.

A discussion forum

This is aimed at fostering technical debate among all manufacturing sub-sectors. Its main purpose is to gather and exchange information on non-tariff barriers faced by industries, as well as to support cooperation among them and with other civil society actors.

There are two major organisms operated by the DMA for this purpose: *Conselho Superior de Meio Ambiente* (COSEMA, Superior Council for the Environment) and the Environmental Board of the Industries of São Paulo. Both entities promote debates related to environmental issues between manufacturing sub-sectors, research institutes, universities, government bodies and agencies, and NGOs. One of the working groups established under the umbrella of the Environmental Board is fully dedicated to addressing the issue of environmental technical barriers to international trade, and its work has already resulted in five proposals:

- Disseminate information and promote technical expertise on "environmental barriers" to international trade, through publications and technical meetings, focusing on a specific industrial sector as well as dealing with the subject in a general manner;
- Analyse life-cycle assessment (LCA) of products and services, including its potential to become an "environmental barrier" to international trade, focusing on Type III Environmental Declarations and Eco-design (issues that use LCA principles based on internationally agreed guidelines). FIESP will also focus on the ISO 14000 series, as well as on responding to the need to disseminate information and promote the technical capability of the industrial sector;
- Channel the results of these proposals to Brazilian government institutions, such as the Ministry of Development, Industry and Trade, the Ministry of Science and Technology, the National Bank of Economical and Social Development, the Agency for Export Promotion in Brazil, as well as competitiveness forums. Mobilize them to address the needs of Brazilian industry and fill the gaps related to: establishment of legal and technical requirements in international trade, improvement of internationally agreed certification and accreditation mechanisms and institutions, and of financial conditions for industry and institutions to enable them to cope with new rules in international trade;
- Promote participation of the industrial sectors, FIESP, unions and industry associations in defining national and state agendas aimed at promoting environmentally preferable products destined specially for foreign markets; and
- Promote studies for the creation of specific labels for environmentally friendly industrial products as well as the adoption by Brazilian industry of existing regional and international labels.

Designing of a state-level solid waste policy

This aims at encouraging debate on national legislation for solid waste management. The main objective is to support the adoption of a comprehensive legal framework that could address issues such as post-consumption waste, the producer responsibility principle and waste management in order to respond to national legislation and demands from Brazilian consumers as well as to meet foreign requirements, such as those related to the EU's WEEE and RoHS Directives.

Environmental management, eco-design and certification

DMA/FIESP has acted as a member of the Committee on Environmental Management in the Brazilian Association of Technical Standards, first through its Sub-Committee XVII, dedicated to the translation of the Technical Report ISO 14062 on Eco-design, and currently through its other eight subcommittees, dedicated to the elaboration and translation of regulations under ISO 14000 series. This initiative is also dedicated to disseminating information and providing technical support on eco-design through partnerships with private and state institutions like the São Paulo Design Center and the Institute of Technological Research, and to fostering environmental certification in industry through technical support, publications and seminars.

Issues for further analysis

The chapter by Vossenaar et al. raises a number of issues relating to trends that, while analysed in the specific context of the EEE sector, have horizontal implications, including for other manufacturing sub-sectors. These questions deserve further attention, not only due to their potential impact in terms of constraints to market access, but also because of their wider implications for developing countries. Some of these issues are:

- The trend towards "green procurement" and its impact on market access for developing countries;
- The risk of developing countries becoming "dumping grounds" for EEE waste and/or "second-best" markets for products that do not comply with environmental requirements in developed-country markets;
- The role of TNC branches in developing countries as potential "compliance inductors" due to compliance goals set by their headquarters in developed countries;
- The impact on market access for developing countries of national implementation of customs union-wide regulations in the case of the EU's WEEE and RoHS Directives;
- Specifically in the case of the RoHS Directive and similar regulations that ban certain materials and substances, the difficulties faced by developing countries that are unable to develop substitutes; and
- The role of intellectual propriety rights (IPRs) involving "eco-materials" (such as alternative substances to those prohibited by the RoHS Directive) in widening the competition gap between developed and developing countries, and possible abuse of market position by a few foreign suppliers.

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The paper by Vossenaar et al. reviews recent developments in regulatory and other policy instruments that address waste resulting from EEE in major markets and their implications for producers in developing countries, especially China, the Philippines and Thailand. It also discusses the adjustment processes in these developing countries. This commentary focuses on the experience of Thailand and the role of technology.

As a result of the rapid and continuous worldwide growth of the electronics industry over the past few decades, Thailand's electronics and information technology-based industries have grown strongly, supported by intense promotional efforts by the Board of Investment (BOI). The EEE sector in Thailand may be broadly classified into the following six groups: consumer electronics, communications equipment, computer hardware, industrial electronics equipment, electronic components and computer software. Surveys carried out in 2004 indicate that there are a little over 400 establishments of various sizes in this sector, employing a workforce of over 592,000. The sector's contribution to total manufacturing GDP has grown, from 1.9 per cent in 1970 to 3.5 percent in 1989 and to 8.3 percent in 2003, mainly through the growth of the electronics sub-group. EEE accounted for 35 per cent of the value of total exports of the country in 2003.

Implications of the EU's WEEE and RoHS Directives for enterprises in Thailand

What are the implications of the EU's WEEE and RoHS Directives for Thailand? The paper describes very well how Thailand is trying hard to adjust to external environmental requirements as well as to the domestic challenges in the EEE sector.

The enterprises operating in the sector in Thailand are either components suppliers or assemblers, and the vast majority (over 80 per cent) are SMEs, although there are also a number of large enterprises. There is a large informal sector which plays a major role in EEE waste management. The EEE sector uses a lot of materials that are not environment-friendly during recycling, and this is a key problem. The informal sector has little knowledge of how to recycle parts in an environmentally friendly manner. There is also little awareness of related health impacts.

Thailand has taken several steps to adjust to the requirements of the WEEE and ROHS Directives, as described in this chapter. The Thai authorities have given considerable importance to enhancing understanding of the major implications of these two Directives for Thai producers. Committees have been created, conceived as public-private partnerships involving government offices, private sector institutions, in particular the Electrical and Electronics Institute and the National Metal and Materials Technology Centre, research institutes, universities and NGOs, to facilitate national level discussions and study the implications. Measures adopted include the Department of Industrial Works' notification concerning the control of imports of used EEE; the NESDB/EEI Green Productivity Movement project; inter-ministerial coordination to integrate laws and regulations; and the issuance of guidelines for environmental management. Furthermore, the Office of Industrial Economics and the Pollution Control Department (PCD) of Thailand have outlined a draft strategic plan on WEEE management based on the polluter pays principle, and on producer, importer and consumer responsibility; it also envisages the setting up of a specific fund for management of WEEE. A PCD EEE pilot project covering mobile phones, cathode ray tubes, dry cell batteries and fluorescent lamps deserves particular mention in this respect. The project aims, among other things, at estimating the volume of EEE waste generated for each product and analysing waste management systems, the life cycle of the products concerned and consumer behaviour with regard to disposal.

In Thailand the large companies exporting to the EU are relatively well prepared to respond and adjust to the requirements of the new Directives. However, SMEs will face severe problems in

meeting the requirements, including rising production costs. It is important to increase the awareness of the manufacturers about the implications of the two Directives and to promote cooperation on waste management. Compliance with the RoHS Directive requires more R&D expenditure to find substitute substances. For example, there is a need to enhance knowledge of how to use alternative substances to heavy metals in order to produce environment-friendly goods for export markets. R&D should be strongly supported, especially in the area of substitute materials for the production of EEE and design for dismantling, reuse of equipment and proper waste treatment. Promoting joint ventures between Thai companies and companies of trading partners (e.g. in the EU) for the development and transfer of technology necessary for substitution and treatment of waste may be helpful in this context.

As discussed in the chapter, the Thai Government has recognized the need to develop national legislation to address domestic environmental concerns, and steps have been taken in this direction. The Ministry of Industry's prompt attempts to address the issues at stake are encouraging. An important initiative is the national eco-labelling programme – the Thai Green Label scheme. The programme aims at materials recovery and resource conservation. Criteria have been developed for 35 product categories, including a number of EE products. To date, of 144 products that have been awarded the label, 66 are EE products.

Several surveys have identified barriers to the adjustment process, such as costs of substitute materials, lack of information about the substitute materials, and lack of supporting infrastructure. It has been observed that most companies are required to modify their material management systems and to realign/re-qualify their suppliers for proper RoHS compliance. The RoHS Directive and similar legislation in other countries is likely to affect SMEs that may not have the resources to undertake R&D projects to develop substitutes. There is concern that these constraints might drive the SMEs from the market. On the other hand, the authors suggest that certain SMEs might be able to move faster in the adjustment process than large companies, precisely because of their small size and decision-making structure. Those SMEs should be encouraged to invest part of their sales proceeds in R&D. In this connection, the Thai Government could play an important role by providing subsidies to SMEs to undertake R&D projects.

The chapter provides examples of initiative taken by the Thai Government, large industries, NGOs and some academic institutions to create and enhance awareness. However, a thorough study of the technology and R&D needed to meet the new requirements is yet to be carried out. In this connection, it should be noted that most SMEs in Thailand receive materials from large producers, either local or overseas. The challenge for the Thai producer is to find competent suppliers that fulfil all necessary requirements. This demands technical and managerial skills for collaboration throughout the supply chain.

Adoption and implementation of adjustment policies by enterprises in Thailand will involve adjustment costs. This may result in an increase in production costs of EEE, depending on the length of the adjustment period. In the EU context, the chapter indicates that the United Kingdom Department of Trade and Industry (DTI) expects component suppliers will probably bear most of the costs of adjusting to the RoHS Directive in the short term, but in the long term they are likely to pass on these additional costs to the assemblers and/or manufacturers in developed countries. As the majority of components used in the developed countries are imported from developing countries, an important issue is the extent to which producers in developing countries will be able to pass on their additional costs to the final assemblers/manufacturers in the developed countries. Unfortunately, Vossenaar et al. do not attempt to estimate the likely impacts of new environmental requirement on production costs, profit margins and competitiveness in the context of developing countries. This is an important issue for Thailand, in particular because EEE is its main export sector.

How far the two Directives will spur innovation in Thailand as well as in the EU is an area for further research. The RoHS and WEEE Directives might lead to innovation in the form of new

technologies, product design and waste management. However, one important question is whether SMEs will be motivated to switch to more innovative products and processes and related eco-design. Here the Government can play an important role; in order to motivate SMEs to undertake innovative activities, tax rebates might be a useful policy option for the Government.

Role of technology

In adjusting to external regulation of the EEE sector, technology can play a crucial role. This is not sufficiently emphasized in the chapter. EEE waste is generated in large volumes because of its technology. Technology means the integral body of knowledge necessary to transform raw material inputs into products and services. In a broad sense, this includes technical know-why and know-how, as well as the managerial skills required for the efficient utilization of inputs to produce quality goods and services. Technology is an important factor in international competitiveness. It is one of the basic elements for improving productivity, enhancing quality, and producing higher value-added products and services. It thereby helps a country move away from its traditional labour-intensive exports and its dependence on primary, natural-resource-based commodities. In this context, a range of technological options can be suggested. EEE firms can adopt new production technology with reduced environmental impacts. This would result in cost increases for purchasing new machinery, technology and manpower in the short run, but production cost savings would be evident in the long run. Firms can also improve process efficiency by reducing their use of inputs in the production of EEE. This would result in maximizing efficiency of production processes while minimizing the impact on the environment. Eco-efficiency can be achieved by using fewer inputs per unit of product. Eco-design, or design for the environment, results in optimization of product use in terms of conservation of natural resources, and reduction of waste, pollution and hazards. This includes reducing resource consumption – both of material and energy – and pollution prevention; for example, smaller units could be designed which would utilize fewer materials, smaller chips would result in lower resistance and packaging could be changed from using foam to paper. The resultant cost-savings would also help firms maintain their market shares of EEE products. Use of recycled or reconditioned parts in equipment such as copying machines, computers and parts can also result in lower production-costs.

To meet the requirements of external regulations (e.g. the RoHS and WEEE Directives) EEE firms might have to invest in technologies which add to costs, including, at least in the short or medium term, operating costs. For example, the DTI study referred to in the chapter lists a number of reasons why the operating costs of technologies using substitute materials may be higher than those using banned substances (for example due to higher energy costs). Firms complying with the regulation may seem less competitive in the market than the non-complying firms in the short run, but non-compliance is not an option for firms participating in international supply chains. It is therefore important to look for win-win situations. Whether changing their technology or undertaking eco-design for reuse/recycling, firms will need more investment. New machinery that has to be bought to produce a new product may be more costly than modifying existing machinery for cleaner technology production. Thus technology plays a very important role in the management of WEEE. The government can help by providing subsidies to EEE firms for adopting new technologies for waste management.

Thailand and FDI

The Thai Government has pursued policies for facilitating the inflow of FDI to build the country's industrial base while at the same time improving the environment. In 2001, the EU was the third most important source of FDI in Thailand after Japan and the rapidly industrializing Asian developing countries.

The WEEE Directive is based on the concept of producer responsibility. Producers are accountable for end-of-life management of their brand products. It is a well-known fact that FDI has played a major role in the growth and exports of these sectors, hence part of the responsibility lies with the foreign direct investors.

Recommendations

The EU and other developed countries should provide assistance in the areas of environmentally sound technology and eco-design so that Thailand can meet the new environmental requirements for the EEE sector.

Developed countries and TNCs should give special attention to the conditions and needs of SMEs in Thailand. It is also essential to create awareness of the environmental and health impacts of recycling of EEE among those involved in recycling activities in Thailand's informal sector.

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The American Electronics Association (AeA), the largest United States high-tech association, and its office in Brussels, Belgium (AeA Europe) welcome this opportunity to provide a sectoral perspective on the matters raised in UNCTAD's *Trade and Environment Review*. Our comments focus on three areas: first, the contribution of a global sector operating in a set of regional jurisdictions (with a focus on the EU); second, several concrete examples of operational challenges, and third, some "food for thought".

Regional solutions vs. the global market

As globalization becomes the norm, environmental legislation seems to be developing at the regional level. As worrying as the lack of coordination is, legislators now appear keen to move into the realms of highly complex product-specific requirements in a sector which is very sophisticated and innovative. It appears environmental issues having no boundaries is a thing of the past.

A clear trend in the other direction, geographically speaking, is that most United States high-tech companies today are "global" to the extent that their supplies, sub-assemblies, components or even designs come from various parts of the world. It is not financially feasible to have manufacturing lines that produce different products for each jurisdiction. In light of uncoordinated environment regulations at the country level, companies are often forced to take the highest legal requirement or standard and apply it throughout their manufacturing lines. Therefore, a regional approach, for example in the EU, will have global impacts in areas where there is either no problem or where the problem has possibly been resolved through an alternative means.

The EU is clearly proving the quickest at creating environmental legislation. Many AeA member companies' business models support the principles of innovative environmental legislation. However, despite significant financial investment in green products, some companies still do not reap the full rewards due to poor or non-implementation/transposition of legislation across the EU – a complex and frustrating system through which to provide technical and practical know-how as well as inconsistent enforcement methods.[6]

This frustration with the EU legislative process is felt across various sectors, but nowhere is it felt more than in the high-tech sector. Many high-tech companies regard themselves as environmental pioneers, forever pushing to improve their products and manufacturing processes either through extending product life-time, reducing energy consumption, or reducing the size of products and components (and therefore the amount of material used) through nanotechnology. The high-tech sector has revolutionized the way of life of billions of the world's citizens. It has provided an extraordinary array of tools to improve our use of finite resources whilst also integrating society, generating jobs and creating economic growth. These remarkable innovators are responsible for providing software solutions for HIV/AIDS and cancer research, and for tracking, predicting and analysing climatic abnormalities, as well as hardware for keeping planes in the sky and our hospitals running, providing improvements in production (such as supply chain management), alternative sources of energy (e.g. fuel cells and wind power) and the backbone of the world's global communications system.

Operational challenges

The concept of the EU's take-back directive – the WEEE Directive – was welcomed by many key stakeholders who were keen to see an EU-wide response to e-waste. Indeed, many AeA companies

saw market opportunities in this Directive, to the extent that they could use their innovative strategies – among others - to redesign boards for reuse in new computers (and hence reduce costs of components), recover precious metals and centralize take-back logistics.

However, the EU system is not ideal for coping with complex and extensive environmental legislation.[7] Article 175 (of the EU Treaty) allows member States to go further than minimum requirements of a Directive, which means there is the possibility of 25 different laws in the EU's single market. Additionally, the Directive requires the member States to incorporate into their national legislation key concepts and practical implementation aspects. This disconnect can be seen in the WEEE Directive where critical obstacles still remain only six months before the deadline for final implementation. Companies face a range of highly complex and costly issues to address, such as registration requirements, how they link with the definition of "producer" and how they are being handled in each member State. Additional issues include: (i) the status of exemptions under the WEEE and RoHS Directives; (ii) RoHS compliance, proof of compliance and liabilities; and (iii) financial guarantees.[8]

As many of the more progressive member States are now realizing, some of the alternatives to lead solder, for example, are far more environmentally unfriendly than what is being banned – in terms of toxicity or reliability (which in turn has heavy environmental costs in terms of products' life-cycles being shortened and having to join the waste stream). Several companies with products covered by exemptions, with the intent of ensuring reliability, are discovering their suppliers do not have the market to continue selling leaded components covered under exemptions. Therefore, the EU will be incurring a reliability risk with lead-free solder alternatives, a risk it has tried to avoid through exemptions.

Furthermore, companies run comprehensive sets of tests and qualifications to ensure product satisfaction. But they will not have the time or resources to put their existing product lines back through the new product development process once RoHS alternatives are incorporated. Again, this Directive has been discussed for years, but companies remain unsure whether their products are covered, and if they are, how to test compliance. To add to the challenge, China is developing an RoHS equivalent which adds another dimension altogether to a global company's response to improving environmental management/stewardship.

The above examples not only divert billions of dollars (or euros) of resources away from the next generation processor or software, which could bring significant benefits to a myriad of users, but also demonstrate that a more global response to environmental legislation is essential for companies and users alike.

Food for thought

The interconnectivity of global markets and supply chains, coupled with different policy responses of governments to EEE waste, has created an opportunity to bring stakeholders together to ensure that environmental laws affecting the EEE sector balance sound, scientific, international trade facilitation and the health and safety of the global workforce.

As the UNCTAD *Trade and Environment Review* recommends, information dissemination between stakeholders should be improved, the United States high-tech sector supports developing a coherent and proactive dialogue to fully involve stakeholders to create a more inclusive policy development process. It strongly advocates harmonizing standards for the cascade of environmental regulations affecting the EEE sector. Harmonization is critical to facilitate the free movement of goods, avoid trade barriers and harness technological advances that contribute to environmental conservation. The many complications surrounding the interpretation, scope, implementation and enforcement/surveillance of the EU's WEEE & RoHS Directives is a clear example of the need for global standards to create awareness among all stakeholders and to provide an opportunity to contribute to policy processes directly affecting industry and governments around the world.

The United States high-tech sector welcomes an opportunity to work through UNCTAD to discuss the UNCTAD *Trade and Environment Review* with key stakeholders, especially its conclusions and recommendations. An enormous opportunity lies ahead to bring stakeholders together to ensure citizens in all countries will be able to benefit from the latest in technological advances provided by the global high-tech sector while contributing to environmental conservation.

Notes to Commentaries

1 Specifically with regard to WEEE and RoHs, an entrepreneur from Lebanon reported to UNIDO that having been fortunate enough to know in advance about the issuance of these Directives, her company invested a considerable amount of money to change its production technology. This enabled her firm to be prepared even before the Directives were approved, allowing it to gain a new and much larger market share by being a key "environmentally friendly" producer.

2 The author is an editor and co-author of the study, *Computers and the Environment: Understanding and Managing their Impacts*.

3 In July 2002, Sony Electronics (Malaysia) launched the Sony Green Partner Environmental Quality Approval Program in Malaysia, which aims to educate suppliers and to establish requirements concerning the use of non-hazardous substances in the manufacture of their products. According to the Sony Electronics (Malaysia) *Environmental Site Report, Year 2003/04* (Sony, 2004), 178 suppliers were successfully granted Green Partner status.

4 The final list of the Recipients of the Association of Certified and Chartered Accountants (ACCA) Malaysia Environmental Reporting Awards 2003 (now the Malaysia Environmental and Social Reporting Awards, MESRA) consisted of 17 recipients. Seven of these were TNCs, 4 of which are from the EE industry: First Silicon (Malaysia), Motorola (Malaysia), Sony Electronics (Malaysia), and Sony Technology (Malaysia) Sdn Bhd.

5 Information on Malaysia's EEE sector can be found on the website of the Malaysia External Trade Development Corporation (MATRADE). Economy, Trade & Industry, Key Export Industries. Electrical and Electronics, at: www.matrade.gov.my/economy-trade/key-industries/electric.htm.

6 Whilst companies divert precious resources into compliance, member States fail to properly transpose legislation. According to the EU's XXI *Annual Report*, there were 3,927 infringement cases as of 31.12.2003, see: http://europa.eu.int/comm/secretariat_general/sgb/droit_com/index_en.htm. With 10 extra member States (which acceded in May 2004) infringement cases are bound to increase as the new countries implement/enforce 1,600 EU Directives (so called "*aquis communautaire*"). It is interesting to note that even member States with significant resources, such as France, lead the pack on non-implementation of environmental legislation (5th EU survey, pp. 39–41, available at: http://europa.eu.int/comm/environment/law/as03.htm).

7 Another feature is the growth of legislation that focuses on products: extended producer responsibility. Companies operating in Europe are required to comply with additional requirements ranging from packaging, labelling, registration, annual reporting, chemical content, energy efficiency, end-of-life treatment through to design prerogatives – the whole life cycle is affected by EU legislation.

8 AeA Europe has an *Environmental Bulletin* which deals with many of these questions: www.aeanet.org/bulletin. Alternatively, for companies owned by United States parent companies, membership details are available at: www.aeanet.org/europe.